Video tutorials and Quick Response codes to assist Mathematical Literacy students in a non-classroom environment: An Activity Theory approach

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COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signed by candidate

Signature: Date: 10 March 2017

Abstract

This study investigated the effectiveness of video tutorials, accessed via Quick Response codes, on Grade 10 Mathematical Literacy students' ability to complete their homework. Students often struggle to complete their Mathematical Literacy homework. To assist them outside of the classroom, an intervention involving video tutorials that explained specific sections of work and how to go about solving problems, was devised. Students could access the relevant tutorials on a mobile device via the scanning of barcodes provided on the worksheets. The effectiveness of the intervention was assessed both quantitatively and qualitatively, through analysis of the participating students' homework submissions and interviews with the students after the intervention had ended. Use was made of the YouTube analytics view count feature to observe how many times the videos had been watched. Feedback forms, focus group interviews and questionnaires were also used to obtain additional data. Unfortunately, the students did not make as much use of the intervention as had been anticipated, and this, together with the very small sample, meant that no meaningful conclusions could be drawn. The students who had made use of the intervention claimed that the tutorials had helped them in their understanding of the relevant concepts, as well as with the completion of their homework. This would indicate that the intervention was potentially beneficial. I have recommended that future research be undertaken in this regard. When trying to understand why so little use was made of the intervention, it became apparent that many of the weaker students were unaware of their limitations in Mathematical Literacy, and therefore did not feel the need to access the available resources offered by the intervention. This is a serious obstacle to implementing such an intervention, and possible solutions are considered.

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1 Introduction

1.1 Overview

This chapter begins with an introduction to the study, situating the research within the context of the declining standards of Mathematics education in South Africa. The rationale behind the intervention is explained, and the intervention itself is described; thereafter the reader is alerted to the primary research question, as well as subsidiary questions. Next, the key concepts are identified and briefly discussed. The significance of the study is explored, followed by an overview of the chosen theoretical framework. Finally, the research design is outlined, along with a brief description of the site, participants, and data collection methods. The chapter ends with descriptions of the chapters to follow.

1.2 Context and Rationale

When considering the teaching of Mathematics in schools, it becomes apparent that South Africa is faring extremely poorly, measured on both a national and a global level. The national statistics for 2012, released by the Department of Basic Education (DBE), were cause for grave concern, with only 3% of Grade 9 learners scoring above 50% on the Mathematics Annual National Assessment (Department of Basic Education, 2013). Statistics released for 2014 are equally disturbing, with the national average for Grade 9 Mathematics having risen from 13% in 2012 to 14% in 2013, only to drop to 11% in 2014. The modal score for Grade 9 learners in 2014 was 4% (Department of Basic Education, 2015: 51). This is, in itself very disturbing, but from these data I was able to calculate the median score to be approximately 6%, indicating that half of the 8 689 students assessed obtained a mark of 6% or lower. In the 2011 Trends in International Mathematics and Science Study (TIMSS) assessment, the results confirmed South Africa's dismal Mathematics situation, with South Africa outperforming only Ghana and Honduras out of the 45 countries that participated in the study (Mullis et al., 2012). In addition, South Africa assessed Grade 9 students, instead of Grade 8, as was protocol, because the assessment was deemed too difficult for the Grade 8 students. This does not paint a very optimistic picture of South African Mathematics education.

One attempt to improve the situation was the introduction of Mathematical Literacy into the school curriculum (Department of Education, 2003). This subject was first examined in the South African Grade 12 examinations in 2008, but was introduced into the Grade 10 curriculum in 2006, as a potential subject choice. This represented a fundamental change in South African Mathematics education. Previously, students could choose from Grade 10 to study Mathematics at either the Higher or Standard Grade, the former being more challenging than the latter, with more advanced concepts, such as rates of change and linear programming (Department of Basic Education, 2002). There was also the option of students not taking Mathematics at all. This system has changed, making it now compulsory for students to choose either Mathematics (at a level somewhere between the previous Higher and Standard Grade) or Mathematical Literacy. There is no longer the option of not taking any form of Mathematics.

At the school where I have been teaching as a Mathematics and Mathematical Literacy teacher, much emphasis is placed on academic achievement, and students can often lose self-confidence and motivation if they are not academically inclined. There is also much pressure put on students to perform by their parents, who believe (often unrealistically) that because their child is in a private school, they should be achieving excellent results. Since my classes are quite small, with the largest consisting of only 20 students, I have more time to help students individually during lessons.

However, the biggest problem I find is not a lack of understanding during the class, but rather outside of the classroom. Many students seem to understand the work during the lesson, as they are able to complete exercises and participate in class, but when assigned homework on the same concepts, find that they do not know how to go about tackling the problems. I find that many students struggle to complete, and some do not even attempt, their homework, as what they thought they understood during the lesson suddenly does not make sense anymore when they get home.

This brings me to the problem that I investigated and that is addressed in this dissertation. I wanted to find a way to assist students once they have left the

classroom. It is all very well explaining concepts during the lesson, but if students are not going to retain this information when the lesson is over, there should be a way to reach them when they are completing their homework and doing examples and exercises.

The technology I chose to use consists of two parts, video tutorials and Quick Response (QR) codes. I used video tutorials which the students could access while they were busy with their homework. Boster et al. (2007) undertook a study in which they investigated the effect of video streaming – the process of watching a video on the internet, without having to download it first or store it on a device (Reed, cited in Boster et al., 2007) – on 6th and 8th Grade Mathematics students' achievement. They found in their study that video streaming positively affected students' performance in Mathematics. This was an expected outcome as studies have shown that visual educational stimuli enhance student engagement, which in turn has a positive effect on performance (Boster et al., 2007). I used video streaming for my tutorials, hence allowing students to stream the videos rather than download them onto their mobile devices. These video tutorials explained certain Mathematical Literacy concepts as well as how to go about answering the questions.

The students were able to access these video tutorials via the QR codes that were printed on their worksheets. If they were struggling with a specific question, they could scan the corresponding QR code with their mobile device. This link led to a video tutorial explaining how to go about solving the problem.

An aspect of this technology that I feel is worth mentioning is that it allows the students to take responsibility for their own learning. It is their decision whether or not to watch the video tutorial, if they do not understand how to solve the problem. There is also the element of delayed response, as the explanation is not given simultaneously with the question. Rather, the student could choose to scan the barcode after first attempting the question. However, as emerged from the data, and will be discussed later in the dissertation, it appeared that students were not necessarily capable of making the correct decision.

1.3 Research Questions

My primary research question was:

> ***In what ways and under what circumstances can the use of video tutorials and QR codes in a non-classroom learning environment mediate high school students' understanding of Mathematical Literacy concepts, and enable them to complete their homework?***

My subsidiary questions were:

- To what extent do students make use of the available technology to complete their homework?
- To what extent does the use of the video tutorials improve the students' understanding of the concepts?
- What constitutes a suitable homework environment and does this coincide with students' perceptions of a suitable homework environment?

1.4 Key Concepts

The key concepts in my study are: (1.4.1) Mathematical Literacy, (1.4.2) video tutorials, (1.4.3) QR codes, (1.4.4) homework, and (1.4.5) homework environments. I will now discuss each of these concepts in more detail.

1.4.1 Mathematical Literacy

Mathematical Literacy should not be confused with Mathematics, as is discussed in the following chapter. The subject deals with practical applications of Mathematics, using contextual examples relating to real life situations. However, many of these examples are contrived and oversimplifications of the situations they are intended to represent. The following chapter includes the views of various academics, debating whether Mathematical Literacy fulfils a useful function in the curriculum.

Students taking Mathematical Literacy have a far narrower choice of study options once they leave school, than students taking Mathematics. This limitation usually extends to career options as well.

1.4.2 Video tutorials

Earlier in this dissertation I defined video streaming. **Video tutorials** indicate the types of videos that will be streamed. As the name suggests, they will be explanatory videos, or tutorials, and will cover the various concepts, explaining how to go about solving specific problems. Video tutorials are tutorials that have been filmed and can be accessed on a computer or mobile device. Leonard et al. (2003) discuss some of the forms they can take: a teacher or lecturer explaining a concept, a whiteboard that a teacher can write on, a slide presentation, or even paper-based content that can be linked to the computer screen through a document projector. In each case certain technology is required, such as a microphone, document projector, etc.

I used a virtual whiteboard application (app) called Explain Everything[1], which allowed me to record the whiteboard as well as my own voice. I was therefore able to write and make notes, as well as add pictures and shapes and move these objects around the board while I explained the concepts. It looks just like a normal whiteboard, and I was able to write and erase easily, in different colours if desired for clarity and emphasis. These tutorials were approximately 1 to 2 minutes in length, and each explained just one concept or example.

Many of these types of video tutorials already exist online, such as the Khan Academy[2], which started off focusing on Mathematics but now has over two thousand videos teaching various Mathematical, Scientific, Economic and Humanities concepts. I considered using these for my intervention, but there were no videos covering all of the required Mathematical Literacy concepts, as this is a subject offered only in South Africa.

There is also criticism of the Khan Academy with regards to how much thought and preparation are put into the videos (Ani, 2013). Salman Khan himself, the founder of the virtual school, has admitted to making up the lessons as he goes along, putting in little prior preparation, and mistakes have been pointed out in his videos. Although

[1] www.explaineverything.com
[2] www.khanacademy.org

the idea of making available free mathematical resources in the form of videos is a good one, if the video lessons are badly taught, or mathematically incorrect, they can be detrimental to students rather than helping them. Having taken all of this into account, I felt that it was best to make my own video tutorials, which I could ensure were suitable, accurate and relevant to the specific South African context.

A problem with streaming video tutorials is that it assumes internet connections will be fast enough to stream and watch the tutorials; however, in South Africa this is not always the case. The internet speed in South Africa is incredibly slow; compared to South Korea, with the fastest average connection speed of 26,3Mbps[3], and the United Kingdom, with an average connection speed of 14,9Mbps, South Africa is far down the list with an average connection speed of just 6,0Mbps (Akamai Technologies, Inc., 2016).

This could certainly make it difficult to watch videos online. As my students attend a private school, one could assume that they would be able to afford a fast internet connection, but this is obviously not a valid assumption for all students. If students do not have access to a fast enough internet connection to watch the video tutorials, this matter must be addressed. This concern is discussed later in my ethical considerations.

1.4.3 Quick Response codes

QR codes are barcodes which can be scanned by a mobile device and redirect it to a website, text message or video, or display whatever data is stored in it (Lombardo et al., 2012). It is easy to download and install a free QR code reader on a smartphone or other mobile device, and equally easy to use it. Lombardo et al. (2012) also note the speed and convenience of scanning a barcode as opposed to typing in a long URL. I linked the codes to web pages with the video tutorials embedded in them, so that when the students scanned the codes they were redirected to the appropriate page with the specific video tutorial they required. They were then able to watch the video on their mobile device.

[3] megabytes per second

1.4.4 Homework

Homework is defined in Chapter 2, and its relevance and benefits are explored. As a key concept, homework is central to my study, with the intervention aimed at assisting students who struggle to complete their homework. The homework I assign my students usually consists of exercises, designed to practise and reinforce concepts covered during the lesson.

1.4.5 Homework environment

A **homework environment** is the space in which homework is done. A suitable homework environment would be a space conducive to working efficiently. In the following chapter, I discuss the factors that contribute to such a space. It is important that students have an idea of what these factors are, so that they are able to make an informed decision when selecting an appropriate space to complete their homework.

1.5 Significance of the Study

This study could potentially shine new light on how students complete their homework and how they could be aided in the completion of their homework through the use of technological interventions. Although similar studies have been undertaken prior to this one, no research of this kind has been done in South Africa, so this dissertation will hopefully serve to pave the way towards a better understanding of how technology can be utilised in helping students in South African schools complete their homework.

Furthermore, this study would be very useful, but not limited to, teachers of Mathematical Literacy. It would be beneficial to teachers of all disciplines, as homework spans all subjects. Any teacher concerned with assisting students with their homework outside of the classroom should benefit from this study. In addition, the Department of Education could find this study particularly useful, as it could potentially alter the way that homework is viewed and dealt with.

One of the many challenging tasks that teachers face in the classroom, especially large classes as is often the case in South Africa, is to be able to devote enough time and

support to all the students who need it. This study could help determine whether it would be possible and effective to give extra support to the students who require it outside of the classroom.

1.6 Theoretical framework

The framework adopted for this study is Engeström's (1987) second-generation Activity Theory model. This is discussed in more detail in Chapter 2, and through the use of a diagram I explain how the elements in the activity system are connected.

1.7 Research design

This study follows an educational action research (Elliott, 1991) design. The methodology therefore involves the stages of problem identification, design and planning, implementation, data collection, and evaluation. These are expanded upon in Chapter 3. The site of the study was a private high school, and the participants were nine Grade 10 Mathematical Literacy students. Data were collected in a number of ways, using methods such as interviews and surveys.

1.8 Overview of the remaining chapters

Chapter 2 defines the key concepts of the research, exploring their relevance to the study. This includes the technology chosen for the intervention. This is followed by a discussion of prior studies, with special attention to methodologies used and frameworks adopted. The chapter ends with an explanation of the theoretical framework used in this study.

Chapter 3 deals with the methodology of the study. It begins with an overview of the research, discussing the research orientation and the type of research undertaken. The site and participants of the study are identified and the methodology is described as a step-by-step process, following the stages of educational action research. This includes the planning, implementation, and evaluation of the intervention. Finally, ethical and validity considerations are discussed.

Chapter 4 attempts to answer the questions investigated in the study. Data are analysed and research questions are addressed. Relevant data are presented in graphical and tabulated form, and the reader is alerted to any trends or anomalies. Using the theoretical framework, results are discussed, and findings are explained.

Chapter 5 reviews what the study has revealed. The answers to the research questions are summarised, and conclusions are drawn where possible. The limitations of the study are discussed. The chapter ends with a final conclusion and recommendations for further research.

2 Literature Review

2.1 Introduction

In this chapter I begin with an exploration of the key concepts. Starting with Mathematical Literacy, and moving on to homework and homework environments, these are defined, discussed, and perhaps even debated. I then turn to the technologies utilised in the intervention, and justify my choice by explaining what they are and the affordances they offer. I also discuss the Dunning-Kruger effect, which will help when making sense of the results in Chapter 4. There are numerous relevant studies that have been undertaken, and I discuss a selection of these, making note of methodologies that were used as well as theoretical frameworks adopted. I end the chapter with an explanation of the theoretical framework I have chosen for this study.

2.2 Exploration of concepts

2.2.1 Mathematical Literacy

2.2.1.1 Facts and figures

The DBE in South Africa defines Mathematical Literacy in the following terms:

> "The competencies developed through Mathematical Literacy allow individuals to make sense of, participate in and contribute to the twenty-first century world — a world characterised by numbers, numerically based arguments and data represented and misrepresented in a number of different ways. Such competencies include the ability to reason, make decisions, solve problems, manage resources, interpret information, schedule events and use and apply technology" (2011: 8).

In Mathematical Literacy most concepts are introduced in Grade 10, and built upon and expanded over the next two years. These concepts include conversions, exchange rates, measurement and percentages. There are various other sections of work in the curriculum, all of which have some practical application to real life, but many of which, such as mapwork, financial documents, and time (Department of Basic Education,

2011), are not what most would consider to be part of a conventional high school Mathematics curriculum.

2.2.1.2 Mathematical literacy: Are its days numbered?

Mathematical Literacy does not cover sections such as algebra, geometry and trigonometry, and it is for this reason that some people, including leading academics such as Professor Jonathan Jansen, do not consider it to be "real" Mathematics (Jansen, 2012). As Robyn Clark writes in the Mail and Guardian Thought Leader, many people are against Mathematical Literacy because they feel that it is "dumbing down our students" (Clark, 2012[4]). Venkat et al. (2009) bemoan the low level of the questions in the final Mathematical Literacy external examinations. The authors found the design of the questions to be a problem in terms of the low level at which students are tested. Reviewing a number of questions from past external examinations, they conclude that with the inclusion of extra details, diagrams, tables of relevant information and scaffolding questions, students are not required to do as much problem solving, reasoning, or making sense of information as would be expected from the criteria given in the departmental guidelines. In fact, the authors go so far as to contend that most of the questions require only basic Mathematical operations (Venkat et al., 2009).

The intended purpose of Mathematical Literacy is to teach practical concepts that students will need to use in their everyday lives, as is explained in the definition given by the DBE above. However, as North and Christiansen (2015) point out, rather than using real-life scenarios, which would allow the students to engage with a practical application of these skills, the contexts of the examples used in the textbooks, tests, and even the final external examinations, are quite superficial and contrived, and do not bear much resemblance to reality. In fact, rather than achieving the desired outcomes set out by the DBE, this subject may instead be equipping students with a misunderstanding of how to manage in the twenty-first century world. Christiansen (2006) provides an example using the topic of global warming. The DBE asserts that students should be able to investigate claims of global warming through the

[4] http://thoughtleader.co.za/readerblog/2012/01/09/maths-vs-maths-literacy-the-continuing-debate/

interpretation of graphs which plot temperature against time of day over a number of years. Christiansen disputes this assertion, with the explanation that in order to meaningfully investigate claims of global warming, a much deeper mathematical analysis is required, as well as a greater understanding of the surrounding issues:

> "Thus, it serves nothing in terms of engaging with global warming or becoming aware of the real uses of mathematics as a modelling tool; it is simply an exercise in reading graphs, in the disguise of global warming issues. In this respect, it is not inviting insights into the complex role and function of mathematics in society" (2006: 8).

Christiansen does concede that there are some areas of engagement, such as observing and identifying correlation in graphs, but adds that the majority of the examples and contexts chosen tend to promote capitalist ideals, rather than focusing on transformative issues. In this way, social inequalities are further cemented, whereas this subject could be used as a means of challenging current norms and investigating ways to improve our country (Christiansen, 2006).

According to North and Christiansen, Mathematical Literacy is "perceived as a limiting qualification" (2015: 1). Students wishing to study a science or engineering degree must take Mathematics in high school. Mathematical Literacy is accepted by higher education institutions, but only for specific degrees or diplomas such as certain Humanities degrees, i.e. the arts or the social sciences. The question of whether to take Mathematics or Mathematical Literacy is therefore a crucial decision for high school students, one which could potentially impact on their future. The choice must be made at the end of Grade 9, to take effect at the start of Grade 10, and it would be expected that much thought, as well as career guidance would be required before this choice is made.

There are, however, students who take Mathematical Literacy without realising the implications this may have once they leave school. Some schools, in order to raise their pass rates, encourage students to take Mathematical Literacy instead of Mathematics without explaining fully what this means in terms of applying to higher education

institutions; these students then leave high school and find that they cannot study the degree or diploma or course they intended to because they lack the necessary requirements (Ikamva Youth, 2013; Twinoburyo, 2014). North and Christiansen (2015) add that many of the students taking Mathematical Literacy are from disadvantaged areas. Denying these students access to many options of study and consequently many career possibilities serves to perpetuate the inequality in South Africa (North & Christiansen, 2015).

In theory, Mathematical Literacy could be an extremely useful subject, in a country where many people would benefit from the skills it professes to teach. However, in practice, the level at which the content is tested implies that one need not have mastered these skills in order to pass, and the contexts are often superficial, a poor attempt to hide the fact the content is mostly basic arithmetic (Venkat et al., 2009). Apart from limiting one's Mathematical education, the subject also limits one's options upon leaving school in terms of study and career possibilities (North & Christiansen, 2015). But in its defence, students are being forced to engage with *some* form of numeracy, whereas before they could have chosen not to take Mathematics at all.

2.2.2 Homework

2.2.2.1 What is homework and is it needed?

Homework, in one form or another, dates back to at least the 1800s (Gill & Schlossman, 2004). Throughout the last hundred years there has also been much debate as to whether or not homework serves any real purpose (Gill & Schlossman, 2004). A study undertaken in the 1930s found homework to be of no benefit to pre-high school students in terms of their academic achievement (Gill & Schlossman, 2004). Homework was even seen by many as potentially detrimental to children's health, specifically the pressure of rote learning, which was thought to cause harm to both mental and physical wellbeing (Gill & Schlossman, 2004). Not being able to play outside due to having to complete homework was another adverse factor, as outdoor play was considered a necessity for a child's healthy development. Critics of homework also argued that there is more to learning than just school work, and that

by spending time on homework, students are deprived of non-school learning (Gill & Schlossman, 2004). There are a number of teaching practices and tools which have been challenged and possibly rendered outdated or no longer relevant in today's educational environment (such as log tables, which, for all practical purposes became obsolete with the invention of the scientific calculator). Homework is one such practice. Two pertinent questions on this topic are whether or not homework is beneficial to students (specifically high school students), and if it is, what type of homework benefits them the most. My intervention was designed as an aid to assist students with homework, and my research questions focus on Mathematical Literacy homework. It is therefore necessary to delve deeper into the concept of homework itself, as well as endeavour to answer the above questions.

Cooper defines homework as "tasks assigned to students by school teachers that are meant to be carried out during non-school hours" (Cooper, cited in Cooper, 1989: 86). Bembenutty (2011) asserts that the homework that teachers assign should have a clear purpose and rationale and that it should be meaningful. But in order to ensure that homework fits these requirements, it is first necessary to establish the purpose of homework. What are teachers hoping to achieve by assigning these tasks to their students? Research by Epstein and Van Voorhis (2001) revealed ten purposes of homework: practice, preparation, participation, personal development, parent-child relations, parent-teacher communications, peer interactions, policy, public relations and punishment. Kitsantas et al. (2011) isolate what they consider to be two of the predominant reasons homework is assigned; these are to supplement learning activities and to practise concepts. Maltese et al. (2012) undertook a study to ascertain whether or not homework is beneficial. They observed the underlying goals of homework to be to practise concepts already discussed and to prepare for upcoming material. The common motif in all three of these expositions is the idea of practice. Maltese et al. (2012) collected data pertaining to the type of homework teachers assigned. They found that 81% of Mathematics teachers "Always" or "Almost Always" assigned homework that involved problems or question sets. This study was undertaken in the United States of America, but from my own experience as a Mathematics teacher I posit that the trend is not unique to that country. In order to

master Mathematical concepts it is necessary to practise, and if there is not enough time in a lesson, this practice may have to be done at home. Cozean states that "homework mastery is important in the learning of Mathematics" (2010: 14). As a Mathematics and Mathematical Literacy teacher, I assign homework questions in order for my students to practise, and in doing so reinforce, the concepts that we have covered in class that day.

Gavin Keller, the principal of a South African primary school which took the decision in 2015 to stop assigning formal homework[5], asserts that homework has no benefit unless a) it is assessed and b) there is what he calls a "master coach" to assist the student. In a radio interview on 567 Cape Talk on the 5th of November 2015[6], he stated that practice makes permanent, rather than perfect, explaining that if a student is practising an incorrect method it will be detrimental rather than beneficial, adding that it is very difficult to unlearn a pattern once it is permanent. It is therefore vital to ensure that students are practising correctly rather than repeating and learning incorrect methods. This is why it is so important that there is someone capable who is available to assist with homework. Maltese et al. (2012) express similar sentiments. In their study the authors tested the theory that there is a positive relationship between homework completion and academic achievement. They noted, however, that this theory is based on the assumption that students completing their homework are doing so with a correct understanding of the work assigned and the relevant concepts involved. If this is not the case, the completion of homework may in fact have negative effects, as it is reinforcing an incorrect understanding of the work (Maltese et al., 2012).

I believe that the purpose of homework should be to reinforce, through practice, the concepts covered in class, and ensure that students understand and are able to apply these concepts. It also provides the teacher with instant feedback as to whether or

[5] http://www.timeslive.co.za/sundaytimes/stnews/2015/11/22/Top-marks-for-school-that-scrapped-homework
[6] http://www.capetalk.co.za/articles/6211/why-loads-of-school-homework-can-be-counterproductive-for-young-kids

not this is the case. When students are unable to complete their homework, it alerts me to the fact that they need some assistance.

Although not extensive, there has been some research undertaken to assess whether or not homework is beneficial at a high school level. Cooper (1989) found that in the context of high school students, homework does have a positive effect, and that achievement is positively related to the amount of homework completed. As Cozean (2010) notes, Cooper also emphasised the value of homework in the subjects Mathematics and Science. In the study mentioned above conducted by Maltese et al. (2012) involving Grade 10 Mathematics and Science students in the USA, the authors detected a positive relationship between amount of time spent on homework and standardised tests scores. They therefore conclude that there is indeed a correlation between the amount of time spent on homework and student achievement, but they also feel that there is "under-realized potential in using homework to effectively impact student learning" (Maltese et al., 2012: 68).

Hinchey (1996) discusses some of the reasons that students give for not doing their homework. Although most of their reasons are what one might expect to hear, it is useful to have students report it themselves. Also, a few of the reasons are not as intuitive as one might think, which is equally useful to note. Some of the reasons include: a lack of time, feeling that it did not benefit them (the students) in any way, and feeling that they understand too little of the work to even be able to attempt it (Hinchey, 1996). I have observed that students in class are often able to complete the assigned exercises without help, so if they are unable to do their homework due to feeling that they do not understand the work, it would appear that they have forgotten the concepts after leaving the classroom. This is the problem which I aimed to address in my research, and the intervention I designed was evaluated as a proposed solution.

Considering the current literature on the topic, I conclude that Mathematics homework at a high school level, in the form of problems and practice questions can certainly benefit learning and performance in tests and student achievement. However, this is true only if the student has a correct understanding of the work

assigned, and concepts needed to complete it. In order for this condition to be met the student must either commence the homework with a good understanding of what needs to be done and how to do it, or, if this is not the case, there must be a way for the student to get assistance, be it in the form of a parent, tutor, or possibly technological intervention.

2.2.3 Homework environments

Numerous studies have been conducted addressing the question of what constitutes a suitable environment for students to complete their homework. For the most part, it has been concluded that different students work best under different conditions, implying that a suitable environment for one student, might not be as conducive to homework completion for another (Hong et al., 2004; Hong, 2001; Hong & Lee, 2000). It is therefore necessary to cater for the various learning preferences of students. Hong and Lee (2000) explain that some students work better in bright light, some with an adult present and, as Ramdass and Zimmerman (2011) note, eliminating distractions is crucial regardless of learning style. It would therefore appear that what constitutes 'a good homework environment' is still not well understood, but studies would suggest that it would involve different factors for different students, rather than one unique solution.

2.2.4 Technology

2.2.4.1 Quick Response codes

QR codes are essentially barcodes, capable of storing much more data than the standard barcodes we are accustomed to seeing on items in a supermarket (Gradel & Edson, 2012). Originating in Japan, they were initially employed as a way of keeping track of vehicle parts (Gradel & Edson, 2012), but have now managed to filter into most aspects of everyday life, including education. As explained in Chapter 1, a QR code can be scanned with a mobile device, using a barcode scanner app. These are mostly free to download. Once scanned, the QR code can display text, direct the user to a website, play a video, etc. To create a QR code is equally simple; there are a multitude of online QR code generators. One need only enter the data required to be coded, and the generator will do the rest. The barcode can then be saved and downloaded, ready to be used. An example of a QR code is shown in Figure 2.1. It is

one of the barcodes that I created for my intervention, and leads to a video tutorial on YouTube.

Figure 2.1 QR code

Gradel and Edson (2012) discuss a variety of innovative and practical ways in which QR codes can be used in an educational context, such as directing students to online surveys or assessment questions whereby the teacher can collect valuable data regarding the class. A seemingly trivial, and for this reason possibly often overlooked feature of QR codes which is emphasised by Gradel and Edson (2012) is the fact that they can be attached to any object or surface. To illustrate how this affordance can be utilised, I offer an example from my own teaching experience. Before I designed the intervention evaluated in this dissertation, I took advantage of the above mentioned feature and created an "Amazing Race" type competition for my students, in which I placed QR codes at various stations around the school and when scanned each barcode would require students to answer a question in order to receive a clue as to the location of the next barcode. The questions involved solving Mathematical problems, but this could certainly be extended to other subjects. This idea is also suggested by Gradel and Edson (2012).

There are a number of other interactive ideas mentioned in their paper, but keeping in mind the nature of my research and intervention, the strategies provided by Gradel and Edson (2012) which resonated with me the most, were those on the topic of extended support. They discuss what they term "on-demand assistance", a means of getting help without contacting the teacher directly (something which is rarely done outside of school hours). When working on a hard copy assignment containing a QR

code, a student is able to “use the QR code as a segué to existing supports that have proven viability” (Gradel & Edson 2012: 58). The supports described include video messages, video tutorials, Frequently Asked Questions (FAQ) documents, and examples of the completed assignment. They commend this system, emphasising that students are able to get assistance at the very time at which they are busy with and focused on the assignment.

In addition to the ideas and strategies involving the utilisation of QR codes, Gradel and Edson (2012) provide some practical tips on the use of the barcodes. They advise teachers to minimise the number of mouse clicks necessary between scanning the code and reaching the desired location. For example, if scanning the barcode takes a student to a login screen where they are then required to fill in their details, click enter, and then possibly click on another link before arriving at the destination, this clearly detracts from the ease and simplicity of use, a well-known advantage of the QR code.

In terms of my intervention, upon scanning the code students are led directly to a video on YouTube. Often the video will start playing immediately, but it is not uncommon to be required to press the play button. At most, however, only one click will be necessary. Gradel and Edson (2012) also include a checklist for teachers to ensure that their QR codes work properly and that they get the most out of them. Points on the checklist include making sure that the barcode leads to a mobile friendly result, placing the barcode somewhere it is easily accessible to scan, using shortened URLs, leaving a white border around the square (known as the quiet zone), and testing the barcodes on various mobile devices with different barcode scanning apps. I adopted these recommendations when creating my materials.

Kossey and Brown (2012) also discuss QR codes and their possible applications, linked with mobile technology, in an educational context. As with Gradel and Edson (2012), they include the idea of printing the barcodes on handouts to include links to video tutorials. In their discussion on the limitations of using QR codes, they mention connection speed for the various mobile devices, as well as the fact that some

students might not have access to the internet through their mobile devices. They also warn teachers against over-cluttering their handouts with barcodes, as putting too many QR codes on a handout may cause students to feel overwhelmed. I have taken this into account when creating my own worksheets, which I will discuss in my methodology chapter. Kossey and Brown (2012), like Gradel and Edson (2012) also alert us to technical aspects related to the codes: reminding teachers to link the QR codes to mobile-friendly websites, and discussing the barcode itself, specifically its size and the amount of data it contains, since these can affect the device's ability to scan the code.

2.2.4.1 Video tutorials

As discussed in Chapter 1, video tutorials are educational videos that can cover a range of topics. Martin and Martin (2015) offer some advice on the creation of these resources. They warn not to put too much into a video, as people learn best when taking in small pieces of information at a time. Rather than making a video covering multiple concepts, they suggest making a series of videos, each covering a single concept. They also advise that videos should not be too long, as students tend to lose interest after a while. In fact, they suggest putting the important information at the start of the videos so that if students get bored and stop watching they will at least have seen the main points. Martin and Martin (2015) stress the importance of ensuring that videos are accessible to all students. This may require adding captions or subtitles, which could be of use to students watching the videos in a noisy environment as well. They also note, however, that subtitles can be detrimental in that some students find it difficult to listen and read and follow what is happening in the video. They therefore recommend using YouTube, which allows viewers to choose whether to have the subtitles on or off. They have observed that the use of an audio narration resonates well with students, as it provides a sense of some sort of human-to-human interaction, even though it is only a video. On the topic of narration, the authors give an in-depth explanation on how to speak when recording the video, in terms of speed, volume, etc. As a teacher I feel that I am sufficiently practised in the art of presenting a lesson, even though a video tutorial is not a face-to-face one.

Martin and Martin (2015) were concerned with creating video tutorials to promote university libraries, as well as helping students to understand all the facilities and services that the library offers and how to use them. Although not entirely the same context in which I am interested, the basic goal is the same. As the authors write, "Meeting the user at their time of need is not a new thought in the library world" (2015: 40). This is the second mention of helping users at their time of need. Gradel and Edson (2012) made a similar comment when discussing QR codes. Technological advancements are certainly developing rapidly, and it would appear that these two forms of technology are able to provide help when and where it is required. They also complement each other very well, as will be evidenced in the reviews of previous studies undertaken.

2.2.5 The Dunning-Kruger Effect

Confucius is believed to have said that: "Real knowledge is to know the extent of one's ignorance". Kruger and Dunning (1999) found, through various tests, that when faced with the task of rating themselves, participants falling into the bottom quartile in terms of test performance, tended to grossly overestimate their ability. This held true for both rating themselves relative to their peers as well as predicting how well they had done on the given tests. The authors concluded from this study that if someone is what they term "incompetent", this person is lacking not only the necessary skills required for performing the task in question, but also the skills required for assessing their own (or, in fact, anyone else's) ability to perform the said task. They posit that: "the skills that engender competence in a particular domain are often the very same skills necessary to evaluate competence in that domain - one's own or anyone else's" (Kruger & Dunning, 1999: 1121). Dunning et al. (2003) agree, noting that: "In many intellectual and social domains, the skills needed to produce correct responses are virtually identical to those needed to evaluate the accuracy of one's responses" (2003: 85). The authors use the example of logic and reasoning; they explain that the skills required for one to form an argument, which is logically sound, are the same skills one requires to identify a logically sound argument (Dunning et al., 2003).

Kruger and Dunning (1999) postulate that it is possible to make people aware of their incompetence, through teaching them so as to improve their ability. However, the authors acknowledge the obvious paradox arising in that for one to possess the skills necessary for recognising one's own incompetence, one would no longer be incompetent.

The trend that Kruger and Dunning (1999) observed, of the bottom quartile greatly overestimating their ability, extended to the rest of the participants, albeit to a lesser degree, except for the top quartile. The authors found that the top quartile tended to underestimate their ability in relation to their peers. The reason for this somewhat symmetrical occurrence is that the participants falling into the top quartile assumed that if they found the test to be easy then other participants must have also found it to be easy. They were therefore not underestimating their own ability, but rather overestimating the ability of the other participants. However, when allowed to examine a selection of tests from a range of the participants, they were able to gain a better idea of the level of their peers and consequently to give a more accurate rating relative to their peers. It is important to note that the top quartile's estimation of their *own* performance on the test was not affected by this exercise, as they were competent and therefore capable of assessing their level of ability from the start. It was their estimation of the rest of the participants' abilities that was altered.

Dunning et al. (2003) note that in order to do well in an exam, a college student must have an idea of how much studying he will need to do. They then comment that "Recent research we have conducted, however, suggests that people are not adept at spotting the limits of their knowledge and expertise" (2003: 83). With this in mind, I refer to the Dunning-Kruger effect in Chapter 4, when attempting to make sense of why students did or did not utilise the intervention.

2.3 Review of prior studies

Much research has been undertaken in North America with regards to video tutorials. The effect of the use of QR codes in conjunction with video tutorials and mobile technology has also been studied. McCabe and Tedesco (2013) undertook a very

similar study to my own in the USA, as did Nurre and Sharkey (2013), even though their research did not involve high school students.

Kalloo and Mohan (2012) investigated whether a cellphone app could assist high school students in Trinidad and Tobago in learning Mathematics. Although the intervention in question was quite different from my own, what I found very useful was one of the data collection methodologies, specifically computer monitoring, which was used to triangulate the data collected, and which I discuss in more detail later in this dissertation.

Kim (2009) investigated the question of whether mobile learning could aid the literacy development of migrant indigenous children in Latin America. An action research approach was chosen, incorporating stages of design, implementation, evaluation, and reflection. Kim justifies this choice by noting that: "Action research has been reported to be an effective research method for technology implication studies involving economically and digitally marginalized populations" (2009: 415/6, referencing Chetty et al., 2003; Hartviksen et al., 2002; Lennie et al., 2005). Kim's study influenced my own choice of educational action research; this is discussed in Chapter 3. Kim (2009) concluded that mobile learning can be useful in the context studied, and that it would be possible to branch out to other subjects. The study, however, was extremely context specific; it is therefore difficult to generalise and assume that these results will hold for other contexts, especially those very different to that of migrant indigenous children in Latin America. Nevertheless, I do think that the aspect regarding children's engagement with mobile technology would apply to learning in any context. If anything, one could assume that it would be easier for children coming from a technology-rich environment to acclimatise to mobile learning, than for children coming from rural villages, who are not conversant with technological devices.

As mentioned above, McCabe and Tedesco (2013) undertook a very similar study to my own. They focused on Grade 7 students in a private school in Canada and used QR codes and mobile technology to help teach a section of Mathematics, specifically

fractions. They uploaded videos on to YouTube explaining core concepts, as well as support videos for homework exercises, which students could reach via QR codes on the worksheets. The authors used mixed method research, comprising both qualitative (interviews) and quantitative (surveys) approaches. Another way in which quantitative data was collected was through a feedback mechanism whereby, after watching the support videos the students could let the teacher know whether or not they had been helpful. They would do this by scanning one of two QR codes (A: "I accessed the video and it was helpful", or B: "I accessed the video and am still experiencing difficulty with the concepts"). This would send an email to the teacher who would get instant feedback about individual students, as well as the class as a whole. The study concluded that mobile learning can certainly have a positive effect in assisting students with their homework.

Boster et al. (2007) undertook a study in the USA to see whether the use of video streaming could have a positive effect on 6th and 8th grade students' Mathematics performance. This study involved a large urban population of 6th and 8th Grade students from four different schools. Two schools were designated as experimental schools and the other two as control schools. However, to reduce the possibility of bias, the two schools that were controls for the Grade 6 students were experimental schools for the Grade 8 students, and vice versa. In the control classes the students were taught as per usual, whereas in the experimental classes the teachers used video streaming to supplement their teaching. The students were then tested on the content taught (for the 6th Grade students: order of operations and circles, and for the 8th Grade students: linear equations and inequalities and parallel and perpendicular lines). The results from this study showed that there was a significant difference in the test scores of the experimental and control schools, and the authors concluded that students exposed to video streaming outperformed those who were not. Some questions raised by Boster et al. (2007) were regarding the use of video streaming in other environments and other learning areas. They were interested in whether video streaming would be as useful in different schools and different subjects. They also posed the question why video streaming had a noticeable effect on students' learning and understanding of the work.

Another study undertaken in the USA was that of Ellington and Hardin (2008), who sought to find out whether video tutorials could be of use in a university Mathematics modelling course to help students learn to use the software required for the course. Ellington and Hardin (2008) felt that too much of the teaching time, in the course in question, was taken up with queries and students needing assistance on getting the software working properly, and not enough time was spent on the actual Mathematical concepts. The authors had the idea of creating video tutorials explaining how to use the software, which the students could watch in their own time, so that when they arrived at class they would understand how to use the program and could focus more on the actual course material. Results indicated that the tutorials did indeed help in that the students came to lectures having learnt how to use the program, and more time was freed up for teaching the content of the course.

Mendicino et al. (2009) researched the use of web-based homework in Mathematics. The study involved four classes of 5th Grade students in the USA, and the homework was to be completed at home, online. Hints and scaffolding questions were incorporated in order to help the students complete the homework, and the work was automatically graded with the marks recorded. From pre- and post-tests, the authors concluded that the web-based homework did have a significant effect on the students' learning. They note, however, that although 76 students participated in the study, not all of these students had access to the internet at home, and that some who did have access chose to rather do their assignments at the computers at school. This limitation regarding accessibility is common throughout South Africa, and therefore something I had to consider with my own research. The authors also note some of the other limitations of the study, including the fact that the program used for the intervention allowed for only multiple choice or short answer questions. Although automatic grading is a useful feature in that it can provide immediate feedback and save the teacher time marking, Mathematics often requires students to show their working when answering questions. In my view, a correct answer does not necessarily provide enough feedback as to whether a student knows what they are doing, particularly in

multiple choice questions. Only by showing how they got to the answer can they demonstrate their understanding of the work.

Another study was undertaken by Jacobson (2006) involving a pre-algebra college course, also in the USA. All homework was to be done on a tutorial system that accompanied the textbook and 276 students participated in the study. Although the student evaluations of the intervention were very positive, with students claiming that it helped them learn, the exam results indicated no significant difference between experimental students and control students. The author concluded that the computer homework had no effect on students' exam performance; however, he does note that this may in part be due to difficulties students experienced in learning to enter Mathematical notation using a keyboard and mouse. Possibly more interesting than the fact that the intervention did not help the students is the fact that the students thought it did. As Jacobson warns, instructors "should not rely on evaluative judgements made by students" (2006: 8). I will refer to and discuss this observation in Chapter 4.

Nurre and Sharkey (2013) conducted a study involving 49 undergraduate students enrolled in an Operations Research course, part of an Industrial Engineering degree at a university in the USA. The authors researched the implementation of what they termed "virtual office hours", video tutorials which focused on certain aspects of a lecture. The tutorials would often include extra or complementary examples to what was covered in the lecture, as well as alternative solutions to problems. They were intended to add to the lecture, rather than repeat it. Once created, the videos were uploaded and embedded onto the teaching assistant's website. Eleven tutorials were created altogether, and the chosen topics for the tutorials were those requested by students as well as those with which they believed students to be struggling. Watching the videos was voluntary, but notifications were sent to the students when new videos were uploaded, and they were given the URL for the page. Data was collected via video view counts, as well as from a student survey at the end of the semester. From the view counts, the authors were able to conclude that students made most use of the videos before homework assignments were due and before the course exams. In fact,

students who watched the videos more than once indicated that they would watch it to help with the homework and also replay it before the exam to reinforce concepts and to ensure understanding. Most students reported that they felt the videos helped and that they would recommend the use of video tutorials. Some of the advantages they mentioned were that the tutorials actively demonstrated the material, that it was possible to pause when needed as well as control the pace of the videos, and that the tutorials helped to bridge the gap between the lectures and homework. Students also praised the on-demand nature of the video tutorials, a feature that I have discussed earlier in this chapter. A limitation of Nurre and Sharkey's (2013) study is that although students were surveyed for their feedback on the intervention, no results analysis was done, so the data collected are purely qualitative. It would be necessary to assess the students' marks in order to conclude whether or not the video tutorials have a positive effect on students' performance. As Jacobson (2006) notes, students cannot be trusted to gauge the effectiveness of interventions designed to assist them.

Cozean (2010) researched the effect of guided homework on a high school elementary algebra class in the USA. Students were given step-by-step worked examples integrated with the homework questions. These worked examples were recorded, and saved onto CDs, and students could click to reveal the next steps one line at a time. Forty-three students, in two classes, participated in the study, and they were divided randomly into two groups. One group received the guided homework examples, whereas the other group did not. All the work was completed in class, in the space of a lesson. The lesson began with a pre-test to evaluate prior knowledge, followed by a lecture on the topic. This lecture was pre-recorded so as to ensure that both classes received identical instruction. After the lecture, students were given "homework", which they were required to complete during the lesson, with those in the experimental group being given access to the guided homework examples. Once the homework had been completed (students were given approximately twenty minutes for this task), the lesson concluded with a post-test. The pre- and post-tests given to the students consisted of multiple choice questions, with the option of "I don't know" included. This was to discourage guessing when students did not know the answer. Four of these lessons were designed and implemented, with the experimental and

control groups swapping halfway through. Students were also asked to keep a tally of the number of times they made use of the guided homework. A final exam was written after all four lessons had taken place, and students were then required to complete a survey about their experience of the intervention. Cozean (2010) concluded that there was no significant difference between the experimental and control groups, but also noted that many students claimed to have found the intervention useful. This once again raises the issue of whether or not students are able to accurately assess how helpful an intervention actually is. Cozean (2010) mentions, however, that a significant improvement could be observed for the lower performing students.

2.4 Methodologies employed in similar studies

It is possible, from the above mentioned studies, to gain a better idea of the advantages as well as the limitations of the technology and its implementation. This prior research serves as a guideline by making apparent what does and does not work in terms of methodologies used.

I noted a number of the methodologies worth replicating. Kalloo and Mohan (2012) made use of computer monitoring as a method of data collection, and in this way were able to triangulate the data. This made it possible to tell whether students were lying about using the intervention, as the sets of data should correlate. If more students claimed to have used the intervention than had actually accessed it according to the computer monitoring system, then the authors would know not to trust the students' responses as some were clearly not answering honestly. Nurre and Sharkey (2013) also made use of computer monitoring, by keeping count of the number of views of the videos. Kim (2009) used an iterative approach, repeatedly reviewing and improving the intervention. This is something that I certainly would have done, had time permitted. McCabe and Tedesco (2013) incorporated a feedback system into their intervention, whereby a student could state whether or not the video had been helpful after watching it.

2.5 Theoretical underpinnings of related studies

Although there exists much literature relevant to this study, with many similar studies having been undertaken, few of these make use of a theoretical framework, or rather, make explicit the chosen theoretical framework. Cozean (2010) discusses the theoretical approach taken in his research. He discusses behaviourism and constructivism, claiming that these two learning theories are widely used in the teaching of algebra. Whereas behaviourism involves direct instruction, with students learning rules and facts, constructivists would argue that students learn by making sense of information and constructing their own knowledge (Cozean, 2010). The author explains that although the teaching of algebra calls for an approach that is more constructivist than behaviourist, some assistance is required in helping the students learn. He therefore resolves to use guided constructivism, where students can be guided while still being able to construct their own meaning (Cozean, 2010).

McCabe (2014) used an adaptation of Engeström's (1987) Expansive Activity Model as the theoretical framework for his study involving QR codes and mobile technology, as he found this model could illustrate:

> "… the complex interactions between the subject, the tool (mediating artifact), the context (community), the communication (division of labour), the control (rules), and the object that will occur throughout this study (2014: 55)."

The study undertaken by McCabe (2014) was very similar to my own; his use and justification of this framework therefore influenced and informed my choice of theoretical framework, which is discussed below.

2.6 Theoretical framework for this study

This study follows an Activity Theory approach. The theoretical framework I make use of is Engeström's (1987) second-generation Activity Theory model. This framework is quite appropriate for the study as it deals with putting an intervention in place and

observing how the system is affected. Figure 2.2 illustrates a second generation activity system, adapted for my intervention. I now discuss the various elements.

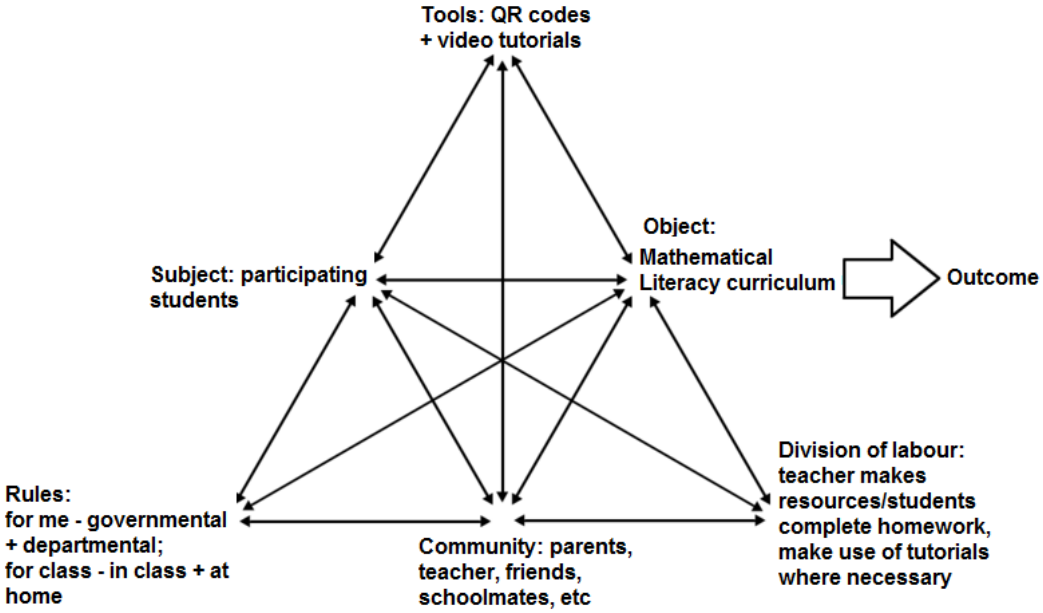

Figure 2.2 Second-generation Activity System (Engeström, 1987: 78), adapted for my intervention

The subject in this activity system is the group of students participating in the study, as they are the ones making use of the intervention to mediate their learning. The subject comprises 9 students, 4 girls and 5 boys.

The object the students act upon is the Mathematical Literacy curriculum, specifically the topics of patterns and relationships, perimeter, area and volume, and probability. This is with the aim of helping them in their understanding of the concepts so that they are able to complete the homework. Put more directly, the object is to help students in the completion of their homework by bettering their understanding of the work.

The tools are the technologies I chose to mediate this process. They are the video tutorials that I created on the above mentioned topics, accessed via QR codes that were printed on the homework worksheets. In order to use these tools, students would need to have mobile devices capable of accessing the internet.

The community is those who might influence the students' use of the videos. This includes parents, friends, siblings, schoolmates, and also non-participating classmates. I am also part of the community, in my role as teacher. Although in this study I take on the role of both teacher and researcher, in terms of the activity system my role is purely that of the teacher, as the researcher is observing the system, and not within it. It is vital to distinguish the two roles, as they hold very different responsibilities. Elliott (1991) has much to say on the topic of the teacher-researcher, in terms of allowing teachers to practically conduct research in order to provide an opportunity for professional development as well as improve their own action within their classrooms. This will be discussed further when explaining my choice of educational action research in Chapter 3.

The rules are the classroom rules, which apply during lessons, as well as the rule that homework must be completed. There are also the rules that apply at the students' homes, i.e. where and under what conditions they are allowed to do their homework; for example, in front of the television, on their bed, while on their cellphones, etc. An important point to note is that there is no rule enforcing the viewing of the videos. It is therefore the students' choice whether or not to watch them.

In terms of the division of labour, my job (as teacher) is to create the video tutorials and the worksheets with the QR codes. The students are required to complete their homework and make use of the tutorials if they need help.

The intended outcome is that students will make use of the tools and that it will aid them in completing their homework. The actual outcome, unfortunately, did not reflect this, but as will be discussed in Chapter 4, the results were nevertheless very interesting and informative.

2.7 Conclusion

This chapter reviewed the key concepts in the study, looking in some detail at the roles of both Mathematical Literacy and homework, as well as the features of a good

homework environment. The technologies used in the intervention were discussed, along with justification as to why they were chosen. The Dunning-Kruger effect was introduced, as it will be of some importance when discussing results in Chapter 4. The reader was exposed to various relevant studies, and methodologies and theoretical frameworks were discussed. Finally, the Activity Theory theoretical framework for this study was introduced and expanded upon. The next chapter will focus on design and creation of the intervention, as well as its implementation. Data collection methods will be discussed, and data analysis methods will be explained.

3 Research Methodology

3.1 Introduction

In this chapter the approach to the study is outlined, explaining how this informed the methodology. The type of research is described, and the site and participants are discussed, as well as a justification provided for why they were selected. The reader is then led through the methodology from design of the intervention and creation of research instruments, to implementation, data collection and analysis, with mention being made of the challenges faced. The chapter ends with a discussion of ethical and validity considerations.

3.2 Research Approach

My study was informed by educational action research (Elliott, 1991). This is a branch of action research, intended for research carried out in a classroom environment, which places the teacher in the role of researcher. As discussed in Chapter 2, Kim (2009) noted the value of action research in studying the effects of technology implementation, specifically in areas which are disadvantaged both economically and digitally. Although this does not necessarily describe the context of my participants, it is certainly true for much of South Africa. The action research model that Kim (2009) used, consisted of four action stages: strategize, apply, evaluate and reflect. This model relies heavily on multiple iterations; for this reason it was not ideal for my purposes, as time constraints limited the scope for iterations within my own study. I therefore opted to use Rossouw's (2009) model, which outlines and structures a process that better suits my research, yet also allows room for revision. Rossouw (2009) considers Elliott's (1991) process of educational action research, and suggests a cyclical model comprising four steps: (i) developing a question, problem or research focus; (ii) survey, literature review and planning; (iii) implementation, monitoring and further data collection; (iv) reflection and review. This model is offered as a guideline, and as such I have modified it slightly to suit my particular research. No survey was undertaken prior to the planning of my intervention; my second step therefore includes only literature review and planning. The structure of this chapter follows this adjusted model in explaining the methodology of the research.

3.3 Developing a question, problem or research focus

The issue being addressed in this study has been identified and expanded on earlier in this dissertation. In my experience, many of the problems which one encounters in the classroom are readily apparent; in terms of methodology, it was therefore a fairly simple process of selecting an issue that I felt to be important. As mentioned in Chapter 1, I was concerned that students did not have access to the necessary resources outside of the classroom to assist them in completing their homework, and therefore wanted to find a way to solve this problem.

3.4 Literature review and planning

3.4.1 Literature review

A comprehensive literature review was undertaken. In this review, key concepts were explored, the chosen technologies were researched, and relevant studies were considered. This provided a basis for the planning of the intervention.

3.4.2 Planning

In order to address the problem, I posed myself the following question: "How is it possible to assist a student, without being physically present?" Potential solutions could be a phone call or exchange of emails. Emails are, however, often subject to delay, and both of these methods require the teacher being available at the moment help is needed. I therefore turned my attention to video tutorials. I could create a tutorial explaining a concept, and students would be able to watch it wherever and whenever they needed to. This appeared to be a promising solution. The next question, however, was one of accessibility. How would the students access the video tutorials? It would be possible to put all of the videos on a CD or DVD, indicating which tutorial corresponded with which question, but this would not be an ideal solution as it would require that the students have access to a computer which can read and play CDs and DVDs. This would also mean that the videos would not be that easy to change and that all the videos would need to be prepared way ahead of the lessons. Furthermore, it would require that the students do not lose, break or damage the discs. A more practical, and potentially more efficient solution would be to upload the videos to the internet, and give the students the appropriate links to the

corresponding videos. Gradel and Edson (2012) recommend taking advantage of technology that "walks in" with the students. As every student in the class was in possession of a smart phone, it seemed convenient to make use of these mobile devices in the intervention. The technology would be simple to utilise, as the students would already be familiar with the device, and the process would be straightforward, as no other equipment would be necessary. The only further requirement would be internet access.

In order to ensure that the process of accessing the videos is also simple, quick and easy, a QR code was the natural choice. Rather than providing a URL, which would require opening a browser and typing the string of characters, a barcode could be inserted in the appropriate place on the worksheet, and the students need only open their scanner app and hold their phone above the image. My intervention would therefore consist of video tutorials accessed via QR codes. In this way, I planned to incorporate technology which not only "walks in" with the students (Gradel & Edson, 2012), but also "walks out" with them, as it would be available whenever and wherever they need it.

The implementation of the intervention was to run over two two-week periods, with a total of 11 homework worksheets to be completed (Appendix A) and 37 videos[7]. An index of all the videos and their content can be found in Appendix N. The Mathematical Literacy sections to be covered over the two periods were: patterns and relationships, perimeter, area and volume, and probability. Most of these topics require visualisation to understand the concepts. Diagrams, graphs and tables are used. The first implementation period was towards the end of the second term, before the start of the mid-year examinations. The second was at the beginning of the third term. The break between the two periods would provide time to evaluate the intervention so far and make improvements where possible. Action research involves an iterative process, where interventions are continually evaluated and improved.

[7] https://www.youtube.com/channel/UCj0ejoIqs2EeWWVI3jBV0KA

3.4.2.1 Creation of materials

I created the videos on a tablet using an Android app called Explain Everything. The app allowed me to write on a virtual whiteboard, using pictures and shapes and with the ability to easily move objects as well as zoom in and out and move around to different areas. I could record the video and my commentary concurrently, and in so doing I was able to use a visual component to explain concepts. The app allows one to pause while recording, but unfortunately not to record over a particular part of the video, which meant that if I made a mistake I would have to start over from the very beginning. Other than this, however, I found the app to be extremely user-friendly, and exactly what I required for my intervention. Figure 3.1 is a screenshot from one of the videos[8].

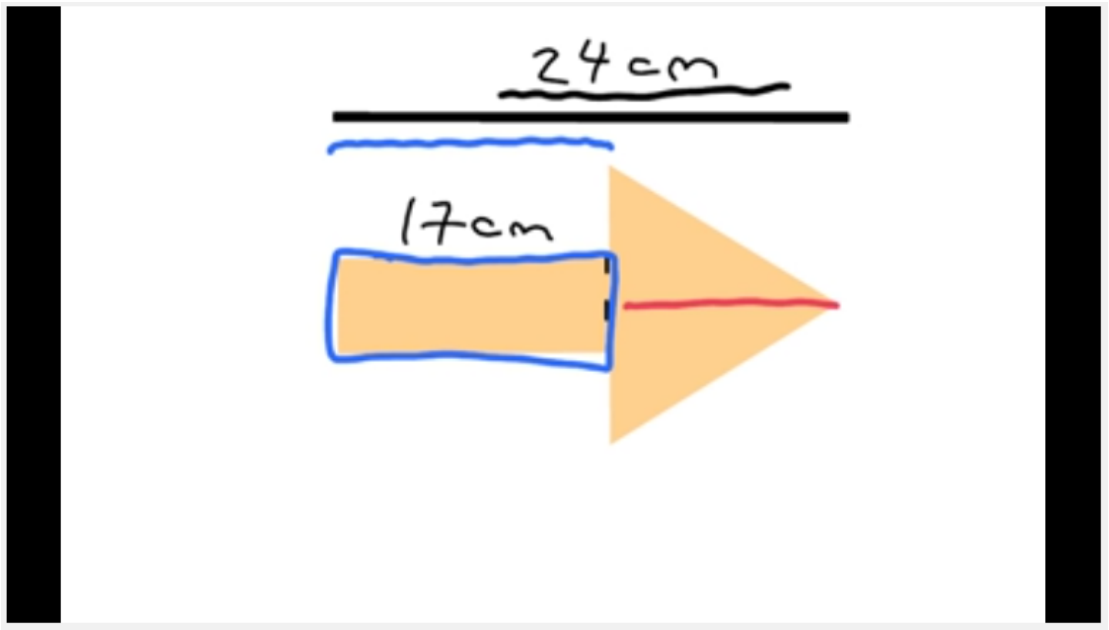

Figure 3.1 Screenshot of video

I uploaded my videos to YouTube, as it was easy to use and had the added benefit of being able to keep track of how many times each video was viewed. This was useful in terms of my data collection and analysis, as I discuss under Data Collection Methods in this chapter. YouTube also gives the option of publishing a video as public, private, or unlisted. Public, as the name suggests, allows the video to be found and viewed by anyone. A private video can be viewed only by people you have shared it with, and to

[8] https://www.youtube.com/watch?v=wHSXO-N41I0

view an unlisted video you must be given the URL. Private and unlisted videos will not show up in searches. I published all of the video tutorials publicly, as I am a firm believer in making educational resources available to everyone. It would perhaps have been better, however, to publish the videos as unlisted for the purpose of this research. In this way it would have been possible to ensure that only the participants could view them and I would have obtained an accurate count of the number of times the participants had watched them. Later in this chapter I discuss how this error of judgment potentially influenced the validity of the YouTube data.

Creating the QR codes was a simple and straightforward procedure. I used a QR code generator[9], which required the URL of the video. Once the video had been uploaded to YouTube, I copied the URL and pasted it into the space provided in the generator. A QR code was immediately created, and I was able to save this as an image on my computer. The final step was to insert these images into the worksheets before printing. As worksheets contained multiple barcodes, it was important to ensure that the correct barcode was placed next to the appropriate question.

I created the homework worksheets to cover the same concepts learnt in class that day. In devising the questions I took care to include at least one covering each concept. As it was often the case that more than one concept was covered in a lesson, there were usually several questions on each homework worksheet, with each question requiring a QR code. This meant several QR codes were needed on each worksheet. Following the advice of Kossey and Brown (2012), I ensured that my worksheets were not cluttered with too many QR codes, allowing no more than four barcodes on a page. The exact number of barcodes per worksheet varied, depending on the number of concepts covered.

3.4.2.2 Type of research

Drawing upon the work of Creswell (1998), this study followed a mixed method approach, incorporating aspects of both qualitative and quantitative research. However, due to the small number of participants (nine students), the quantitative

[9] https://www.the-qrcode-generator.com/

data are not sufficient to ascertain any trends or correlations in the students' results. Although quantitative data will be discussed and interpreted, these interpretations are on a superficial level, dealing with the students as individual case studies rather than searching for generalisable trends. The results analysis in this study deals mostly with the qualitative data collected. These qualitative data proved very useful in determining students' reasons for watching or not watching the videos.

3.4.2.3 The site

The study was undertaken at a private high school, situated in Cape Town, South Africa. The school consists of Grades 10 – 12, and each grade is divided into five classes. The classes are small (approximately twenty students per class). The majority of the students take Mathematics, with the result that the Mathematical Literacy classes have fewer than twenty students. My reason for choosing this school was purely one of convenience – I was teaching there when I commenced the Masters in Information Communication Technology in Education course. I was the Mathematical Literacy teacher and therefore had easy access to a class of Mathematical Literacy students. Since it was my own class, I was also able to ensure that the necessary work was covered during the lessons and that the correct worksheets were assigned for homework. Having a relationship with the students also proved to be beneficial, as it meant I had insight into their personalities, which aided me in explaining and understanding certain anomalies in the data. It did, however, also have its disadvantages, as I explain in the ethical considerations in section 3.7 below.

3.4.2.4 The participants

The participants in the study formed part of my class of Grade 10 Mathematical Literacy students. I did not want to use my Grade 12 class as this was a crucial year for them, involving a large amount of stress and I did not want to add to this. I selected my Grade 10 class as they were new to the subject and had therefore not been exposed to the content before. The same sections are built upon in Grades 11 and 12, meaning that these classes would be covering work that they learnt the previous year. There were, in fact, eleven students in the selected class, but two of these students opted not to participate. The remaining students were a mix of 5 boys and 4 girls, with ages ranging from 15 to 18 years, and Mathematical Literacy term marks ranging from

40% – 86%. The participants are introduced below in Table 3.1. The names used are pseudonyms so as to keep their identities confidential.

Table 3.1 Participants

Boys	**Girls**
Brian	Hayley
Fred	Mandy
Greg	Megan
Kyle	Sarah
Phillip	

3.4.2.5 Questionnaire and focus groups

I designed a questionnaire to be completed by the students prior to the implementation of the intervention (Appendix B1). The questions were predominantly on the topics of Mathematical Literacy and homework, and most either made use of a Likert-type scale or required one-word answers.

My second research instrument was a focus group (Appendix C). As with the questionnaire, this took place before the implementation of the intervention. The hope was that the focus group would allow for the students to express how they felt they were coping with the subject, both in and out of class. The idea was to collect data comprising answers to longer, open-ended questions, giving students a chance to further explain their answers. It also gave me an opportunity to follow up on unanticipated answers, as well as clarify answers that would otherwise be difficult to understand and interpret. Depending on student responses, some questions may have been slightly adapted or omitted, or different questions added. Any changes are indicated in Appendix C.

3.4.2.6 Other research instruments

I created Student Feedback Forms (SFFs) to enable students to indicate, on a daily basis, whether or not they had watched each video. Each student was assigned a form, and all of these forms were kept on my desk. When submitting their homework at the beginning of each lesson, the students were handed their respective forms, and asked

to fill in the rows pertaining to that homework assignment, and the associated videos. If they had watched a particular video, they could rate how helpful it had been (on a scale from 1 – 5), and give any comments or feedback if they so wished. The forms were then returned to my desk for safekeeping. In order not to breach confidentiality, I have not included the actual forms; rather, a pro-forma is provided (Appendix D).

I also devised a Teacher Feedback Form (TFF) for me to keep track of the students' homework. There was a scale for me to indicate how much of the homework a student attempted, as well as to what extent it was correct, and a space where I could add any comments. As with the SFFs, there was a TFF for each participant, and once again a pro-forma is provided (Appendix E).

At the end of the second two-week period, the students were interviewed (Appendix F), either individually or in small groups. The intended purpose of these interviews was to learn about their experience with the intervention, and their reasons for using or not using the video tutorials. Students were also asked to suggest improvements to the intervention. As with the focus group questions, these may differ slightly from the actual questions asked. Again, changes are indicated in Appendix F.

3.5 Implementation, monitoring and further data collection

3.5.1 Implementation

The questionnaire administration and focus groups took place on the same day, during a lesson, in the week prior to the commencement of the intervention. The participants were randomly divided into two groups, with four students in the first group, and five in the second. While I interviewed the first group, the other completed the questionnaire, before swapping over.

During the week before the commencement of the intervention, students were constantly reminded to download an app for scanning barcodes on their phone. The day before the commencement, those who still had not downloaded the app were given time in class to do so. The students were then shown how to use the app, before

being given a piece of paper with a QR code for them to scan. This QR code did not link to one of the tutorials; it linked to a video demonstrating a card trick as a fun example. The idea was that the students would practise the process of scanning a barcode and watching a video, meaning that the choice of demo video was irrelevant. However, as will be discussed in the following chapter, an interview response suggested that one of the actual video tutorials might have been a better choice.

On the first day of the intervention it was explained to the students that the QR codes on the homework worksheets could be scanned in order to link to video tutorials, should they require assistance with a particular question. The lesson proceeded as per usual, and the homework worksheets were handed out a few minutes before the bell rang at the end of the lesson. I quickly realised that this was a mistake, as some students began completing the homework during the last few minutes of the lesson. This would clearly defeat the purpose of the intervention, which was designed to assist students with their homework outside of the classroom. I therefore changed to handing out homework as the bell rang.

After class each day, I would mark the submitted homework, and note the results on my TFFs, one student at a time. On these forms I would indicate how much of the homework was attempted as well as to what extent it was correct. In terms of the practicality of the design of both the SFFs and TFFs, it would have been more effective to have included a description of each video, rather than merely assigning them numbers. With numbers only, it was often difficult for the students to recall which video covered which concept. This tended to cause unnecessary confusion, both for myself and for the students.

There were several issues that I faced during the first two-week period of the intervention. Firstly, these lessons took place during a time in which South Africa was experiencing power outages (referred to as “load-shedding”). This meant that there were intervals when the school was without electricity, often disrupting lessons. I recall a specific occurrence when a power cut took effect during break. Instead of the usual (electric) school bell, a teacher was sent around the entire school ringing a hand

bell. By the time all students had been made aware of the fact that break had ended, and found their way to class, the lesson was almost over. I therefore had to rush to get through everything I had planned to, as it was all included on the homework worksheet for that day. Secondly, a student teacher was assigned to me during the term, and she came to me on more than one occasion, at very short notice, to inform me that she was required to teach a lesson. This was extremely inconvenient, as I had already planned my lessons and created the homework worksheets. I therefore asked her to teach a different section of work, but this was still inconvenient, as it meant the students were switching between sections every few days. Thirdly, students were often absent. This was not an unusual occurrence, especially with certain students, but it did add to the difficulties I faced.

3.5.2 Monitoring

During the break between the two implementation periods, I assessed the intervention to date. It was clear that not many students were making use of the videos; I therefore tried to devise ways in which to encourage them to do so. One idea was to increase the difficulty of the homework questions, or possibly to include a more challenging question, which would require students to watch the video for assistance. Another idea was to ask students to redo the incorrect questions from their homework, in the hope that they would then make use of the videos. These two ideas were integrated into the implementation of the second half of the intervention.

When recommencing the intervention in the third term, load-shedding once again proved to be an obstacle. In fact, one student commented that she was unable to complete her homework and watch the video tutorials due to the lack of electricity. In terms of the content, the students seemed to find these sections to be more difficult, and this was reflected in the homework completion.

3.5.3 Further data collection

Shortly after the intervention had ended, students were interviewed, either in small groups or individually. During these interviews (of about ten minutes each) they were asked, among other things, to suggest any improvements to the intervention. Had the

study extended over a longer length of time, I would have attempted to incorporate some of these suggestions, before re-evaluating. Nevertheless, I include the suggestions in the coming chapters, along with my own recommendations for improving the intervention.

Shortly after the questionnaires had been completed, the data were captured in an Excel spreadsheet document (Appendix B2). Each question was assigned its own sheet in this document, and for each question similar answers were grouped, so as to identify the most common responses. It was also indicated on each sheet which answer was given by which student. This allowed for individual case studies to be constructed and analysed. To facilitate analysis of these data, questionnaires were assigned numbers, from one to nine. In this way students' responses could easily be discussed and compared.

Transcribing the focus group interviews proved to be a long and laborious process. In order to ensure that I had captured all responses accurately on the transcript (Appendix G), it was necessary to listen to excerpts of the recordings multiple times; I also called upon the assistance of colleagues to either validate or correct what I thought I had heard. Some responses had to be classified as indistinct, with no discernible words. Others were noted as noises of agreement. This was not uncommon in the focus groups, as not all students spoke much, preferring to affirm what another student had said. By contrast, a few of the students were very forthcoming with information, and happy to go into much detail when answering questions. Once transcribed, the interviews were listened to again while reading the transcriptions to confirm the accuracy of the text. The text was saved as a Word document, with line numbering, so as to easily be able to find and discuss specific responses.

The post-intervention interviews were transcribed (Appendix H), another time-intensive exercise. Due to the fact that these interviews were conducted in smaller groups or individually, it was possible to get more data from the students, as grunting their agreement was no longer an option for some. However, many did resort to one

word answers. As with the focus groups, once transcribed, the interviews were listened to while reading the transcriptions to ensure text accuracy. These interviews were also saved in a Word document, with line numbering.

A number of the advantages afforded by YouTube have been described earlier in this dissertation, one of which is the ability to keep track of the number of views of each video. These data are obtained via the YouTube analytics feature, illustrated in Figure 3.2 below. This meant that I was able to know for certain how many times each video had been watched. In this way I could triangulate my data – if six students had professed to having watched a video, but YouTube indicated only four views, I would know that not all of the students had reported honestly, and I would be cautious when analysing their responses to other questions. Although YouTube records the number of views of a video, it does not provide any information about the identity of the viewers. Therefore it would be impossible to differentiate between five students watching a video, and one student watching it five times. It also means that I could not differentiate between a participant watching the video, and a non-participant watching it. This is discussed under validity considerations.

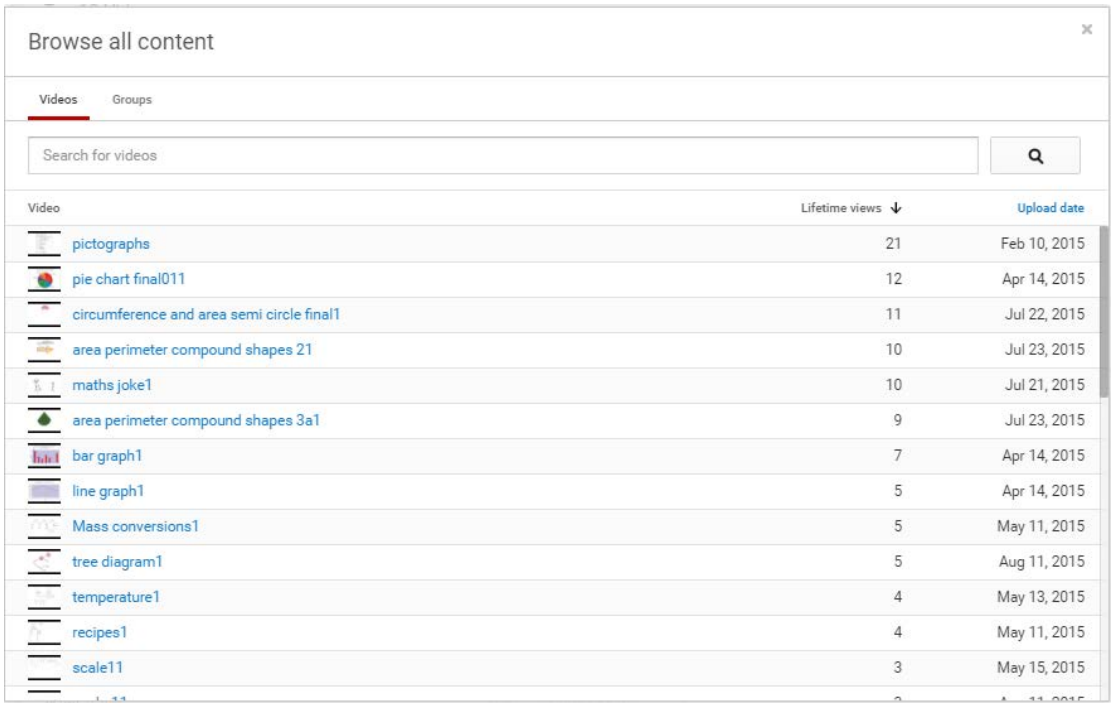

Figure 3.2 Screenshot of YouTube analytics

The students' Mathematical Literacy marks for the first, second, and third term were recorded. This information was kept strictly confidential. The marks were taken from the school database, and were printed as a class list, with the two non-participating students removed from the list.

Due to my dual role as both researcher and teacher, I not only collected the research data, but also dealt with the participants on a daily basis. I was therefore able to observe their behaviour and interactions in class. I made notes of anything I felt to be of relevance to the study, and took these notes (Appendix I) into consideration when analysing the rest of the data.

3.6 Reflection and review

Once the questionnaire data had been captured, these data were analysed, along with the focus group transcripts, identifying the most common responses among students. The small number of participants made open coding a comparatively trivial task. However, following the process outlined by Creswell (1998), the data were axially coded, identifying and grouping similar themes. Creswell's (1998) methods for categorising data and discerning trends were well suited to this analysis, as they allowed for sorting students' responses in order to determine resonance among them. These commonalities are discussed and explored in Chapter 4. Individual questionnaires are also discussed as case studies.

The students' marks from the first and second term were used as a means of classifying the students, in terms of those coping and those in need of assistance, as is explained in Chapter 4.

In trying to make sense of why students did or did not make use of the video tutorials, the interview responses were analysed, once again following Creswell's (1998) process of coding the data to identify trends and similarities. As with the questionnaire data, the small sample size meant that open coding was rendered trivial. Axial coding was fundamental in determining specific themes throughout the interviews. The most common of these are revealed and discussed.

3.7 Ethical considerations

When transcribing the interviews, the names of all of the participants were changed, so as to keep their identities confidential. This was explained in the initial letters requesting consent. Care was also taken in ensuring that no other teachers at the school had access to the data collected, regardless of whether or not they taught the students in question.

Another issue of concern was that of connectivity. If students did not have access to the internet, an alternative plan would have to be made. This was also clearly expressed in the initial letter requesting consent. The letter explained that if a student wished to participate in the study, they could do so regardless of their situation. If students were not in possession of a smart phone, or did not have regular access to the internet, they were to come speak to me, so that something could be arranged. Fortunately, none of the students had any issues in this regard.

Having decided on the intervention, I requested permission for undertaking the study from both the chosen high school and the Western Cape Education Department. The letter sent to the Department may be found in Appendix J. In the case of the high school, I did not send a formal letter; rather, I set up a face-to-face meeting with the principal in which I outlined my proposed research, and he granted me permission to conduct this research at the school.

Once I had selected my Grade 10 class for this study, letters were sent to the students in this class as well as to their parents (Appendices K & L). The letters addressed to the students differed slightly from those addressed to the parents, but both gave a brief explanation of the study, including all necessary information. I deliberately did not give any indication of the research questions, as I did not want the participating students to be influenced in any way. Students who agreed to participate in the study were required to complete and sign an acknowledgement indicating their consent. Parents, too, were required to complete and sign a similar acknowledgement. In order for a student to participate, it was necessary for both the student and his or her parent to give consent. Most students completed and signed their forms in class, returning

them to me fairly quickly. Eventually all parents consented, but two students chose not to participate, as mentioned earlier. It was emphasised in the letters that there would be no repercussions for choosing to not participate in the study. While the participants would receive QR codes on their homework worksheets, linking to the video tutorials, those not participating would be given homework worksheets without the barcodes. Although this denied the non-participants access to the videos, this was necessary because view counts of the videos were recorded as quantitative data. Had the non-participants viewed the videos, this would have distorted the data. As it is, the data may possibly be inaccurate, due to the videos being publicly available; an issue that is discussed further in the following section.

3.8 Validity concerns

As mentioned earlier in this chapter, having a pre-existing relationship with the students proved useful in certain ways. However, it could potentially have a detrimental effect on the results. Considering my role as both teacher and researcher, it may be difficult for students to distinguish between the two. During interviews, it is possible that the responses given to the "researcher", are what the students think I (their teacher) would like to hear, rather than honest answers. It is also possible that students may be embarrassed or ashamed to tell me something. There is clearly a difference between confiding in a stranger, whom you are unlikely to meet again, and a person you see, and interact with, almost every day. It is also important to note the power dynamic in the situation, as this could certainly aggravate the issue. Although I emphasised to the students that all answers should be truthful, and that all information would be dealt with confidentially, it is still possible that students were not completely honest in their responses. It was for this reason I planned to triangulate my data, by using the video-monitoring data in conjunction with the students' answers. However, those data could also be unreliable due to the fact that the videos were published publicly on YouTube, and thus it was possible for anyone to watch them. Although unlikely that someone other than one of the participants would have watched a video, one cannot know for sure. I did receive a notification that a person had subscribed to my video channel, who did not appear to be one of the participants,

indicating that an outsider did potentially view at least one of the videos. This means that the data collected from YouTube may not be entirely accurate.

3.9 Conclusion

In this chapter I outlined the type of research undertaken, situating the study within the area of educational action research. This research approach informed the structure of the chapter, following the step-by-step cyclical process described by Elliott (1991) and adapted by Rossouw (2009). Beginning with the problem identification, I explained how I decided on a research question, and went on to discuss prior research undertaken in the form of literature reviews and pre-intervention surveys. I then detailed the planning and design of the study. The implementation and data collection phase, including questionnaires, focus groups, feedback forms and interviews was discussed thoroughly. Data analysis techniques were revealed and explained, preparing the reader for the results discussion in Chapter 4. The chapter then ended with ethical and validity considerations, noting all issues concerning these factors that potentially could have arisen, and the steps I took to avoid them.

4 Findings and Discussion

4.1 Introduction

In this chapter I analyse and discuss the data collected. To begin, I consider the situation prior to the intervention, using the responses from the questionnaires and focus groups to either affirm or amend my original assumptions regarding the students. These data describe the context in which the intervention was implemented. I then use the data collected through the YouTube analytics as well as the SFFs to determine which students had made use of the videos and to what extent. I examine the TFFs, observing how students fared with their homework, keeping note of whether or not they had used the videos. I also include the term marks of the students, for Terms 1, 2 and 3. These marks are used as a means of discerning between students who I felt needed extra help with the work and those who appeared to be managing. The data from the post-intervention interviews are analysed and I note the recurrent themes in their responses. All of these data are considered in answering my research questions, and I endeavour to answer each question, including where the respective data came from. Finally, I discuss what this could mean for future research and comment on any trends and anomalies.

4.2 Pre-intervention – understanding the context

To gain a better understanding of the class, specifically their attitudes towards Mathematical Literacy as well as their perceived ability, I asked the students to complete a questionnaire a few days before the intervention commenced. This questionnaire, coupled with the data from the two focus groups, served to provide a context for the research undertaken. I now discuss a selection of the questions and responses I found to be most useful and insightful.

In the questionnaire, the majority (n=5) of the nine participants said that they found Mathematical Literacy to be of average difficulty. Only one student rated the subject as difficult; the remaining three as easy. When asked about their understanding of the work in class, all nine participants claimed to understand the work at least most of the time. In fact, the majority (n=5) said they understand the work in class all the time.

These responses are displayed in Table 4.1 below. The participants were also asked this question in the focus group, in order to obtain a more in-depth response. The answers matched those given in the questionnaire, with most participants not feeling a necessity to go into more detail than a simple "*Pretty well*" or "*Most of the time*". One participant did elaborate slightly, explaining that he struggled with "*Just some concepts*" (Phillip, Appendix G, line 160), implying, as one would expect, that some sections of work are more difficult than others.

Table 4.1: Students' perceptions regarding Mathematical Literacy

I find Mathematical Literacy to be:	Difficult	Average	Easy
	1	5	3
I understand the work in class:	Everyday	More than half the time	
	5	4	

There is a prescribed textbook for Mathematical Literacy, which we would often use in class, and it was not uncommon for me to assign exercises from the textbook for homework. I created my intervention with the aim of assisting students with their homework; I therefore was interested in knowing whether the students found the textbook to be of any use. If the textbook was able to provide students with the necessary assistance, there would be little need for my intervention. It was for this reason I asked the participants to rate the usefulness of the textbook in the questionnaire. Their responses, tabulated below (Table 4.2), confirmed my suspicion that they did not find the textbook to be very helpful in explaining concepts, with only two students stating that they found the textbook to be useful more than half the time. Five of the students found it to be of use less than half the time, and one student actually said that she never found it to be useful. One student did not even possess a textbook at the time of completing the questionnaire, as he had recently switched from Mathematics to Mathematical Literacy, and had not yet purchased one. It was apparent that students were lacking in useful resources to help them in completing their homework.

Table 4.2: Students' perceptions of the usefulness of the textbook

The Maths Literacy textbook is useful in explaining concepts:	More than half the time	Less than half the time	Never
	2	5	1

*Only eight of the nine participants responded to this question as one student did not possess a textbook.

As I was about to implement an intervention involving the completion of homework, I felt it necessary to learn more about the homework habits of my students, as well as their attitudes towards the Mathematical Literacy homework I would assign. In the questionnaire, the majority (n=5) of the participants stated that they attempted their homework every day. Two said that they attempted their homework most of the time, and the remaining two students admitted to often not attempting their homework. When asked about whether they struggle with the homework, none of the participants indicated frequently struggling. Five students answered that they never struggled, and the rest said they did not often struggle. These results are displayed in Table 4.3 below.

Table 4.3: Students' responses regarding homework

I attempt my Mathematical Literacy homework:	Everyday	More than half the time	Less than half the time
	5	2	2

I struggle with my Maths Literacy homework:	Less than half the time	Never
	4	5

In the focus groups these answers were elaborated on. Four participants explained that they would finish their homework in class quickly before the bell rang ("*Well I usually finish my homework in class when you give us that like five minute time to do it*." – Megan, Appendix G, line 65 – 66; "*I usually finish it here. It just makes it easier*."

– Brian, Appendix G, line 193). I would often allow the students a couple of minutes to start the homework at the end of the lesson if there was still some time before the bell. These four students claimed that they were able to finish the homework without struggling ("*I usually finish it in class.*" [You don't' struggle with it? You find it fine?] "*Most of the time, ya.*" – Fred, Appendix G, line 80, 84). However, my assumption was that the students struggled outside of the classroom, some time after the lesson. If they were to attempt the homework in class, the work would still be fresh in their minds, making it easier to recall the relevant concepts and methods. Therefore I was more interested in those students who attempted the work at home.

Of the remaining students, there were two whose answers were not in accordance with the questionnaire responses. One student admitted that she was not able to do her homework well. Although she had indicated on the questionnaire that she did not often struggle with her homework, when asked the question directly in the focus group she gave what is probably a more honest answer. She also explained that she was still in the process of catching up work she had missed, offering this as a reason for struggling ("*Um ya, I'm still catching up, so I don't know*" – Hayley, Appendix G, line 90). It is true that she had missed some work, as she joined the class halfway through the first term. However, by the time of the focus group meeting, she should have been up to date with the content. Another student had joined the class near the end of the first term, and was also in the process of catching up the missed work. His response was that he did not have time to do the homework as he was too busy catching up the work from the previous term ("*I don't have a chance to do Maths Lit […] Cos I've been catching up.*" – Kyle, Appendix G, line 72, 76). This is, of course, not an ideal (nor condoned) strategy. But for the most part, from the two sets of data, it would seem that the students do not feel that they struggle with the homework.

Another questionnaire question asked how often the students needed someone to re-explain the work to them at home, and an overwhelming majority (n=7) answered that this is never required (Table 4.4). Finally, the participants were asked how often they completed their homework. Most students (n=6) responded that they complete their homework every day. From this data it is possible to conclude that the majority of the

students feel that they are able to do the homework quite easily, without needing any assistance.

Table 4.4: Students' responses regarding homework (contd)

I need someone to re-explain Maths Literacy work to me at home:	More than half the time	Less than half the time	Never
	1	1	7
I complete my Maths Literacy homework:	Everyday	More than half the time	Less than half the time
	6	2	1

*The reader may have noticed an obvious anomaly in the questionnaire responses – more students claim to complete their homework everyday than claim to attempt it. The only possible explanation I can think of, is that due to the fact that the two questions were spread out in the questionnaire, a student may have forgotten his/her answer to the first, and had a different thought when responding to the second.

I also asked in the focus groups what the students felt the difference was between classwork and homework. Some themes that came up more than once were the ideas that (i) homework is "*more from memory*" (Fred, Appendix G, line 101) and (ii) it is going over what was covered in class. This is in line with my own views on homework, and the fact that students feel that it is necessary to remember the concepts in order to complete the homework strengthens my assumption that they may forget the concepts by the time they attempt the homework, thereby needing some form of assistance.

4.3 Data analysis

4.3.1 To what extent do students make use of the available technology to complete their homework?

Data from the SFFs indicated that five of the students had made some use of the video tutorials. However, it emerged from the post-intervention interviews that one of the students had not been entirely truthful on her feedback form ("*I think I watched one*

in class […] Ya, that's the only one I watched." – Hayley, Appendix H, line 574, 578). She indicated on her feedback form that she had watched most of the videos, but in the interview stated that she had watched only one, in class, referring to the example video that I had showed them the day before the intervention commenced, to demonstrate how the process works. She also admitted that she had not even downloaded the app, which would imply that she watched the video on a classmate's phone.

This inconsistency between the SFFs and the post-intervention interviews alerted me to the fact that not all of the data collected were necessarily reliable. It was in anticipation of this that I chose to collect these data in three different ways, so as to be able to identify such discrepancies and work around them. Although the YouTube view counter was deemed potentially unreliable, due to the videos being publicly available, these data, for the most part, correlated with the interview data, where four participants claimed to have watched at least one video (Phillip, Appendix H, line 424; Brian, Appendix H, line 344), and of those, two said they had watched all of the videos (Megan, Appendix H, line 71; Fred, Appendix H, line 141). The analytics show that each video has been watched at least twice, with some having been watched multiple times; screenshots of the YouTube analytics view counts of the videos can be found in Appendix M. Taking these three sets of data into account, and resolving incongruences through triangulation of the data, I was able to conclude that two students made regular use of the intervention, one student used it on a number of occasions, and the rest (two-thirds of them) made either very little use or no use whatsoever. This was not the outcome I had expected and I was curious as to why so few students had watched the video tutorials. I was also curious as to whether the students who had watched them were those in need of help.

When asked why they watched the videos, the students' unanimous response was that they were stuck or struggling with a question ("*Well, there would be a certain equation or a certain section that I'd be struggling with, and then I'd just watch it to egg me on*." – Megan, Appendix H, line 20 – 21; "*Um, because I was stuck on a question*" – Fred, Appendix H, line 91; "*Ya, I only watched when I needed to.*" – Brian,

Appendix H, line 385; "*Yes, if I didn't understand a concept or something*." – Phillip, Appendix H, line 428). They also stated that the videos helped them in these situations, and gave reasons as to why they found them to be helpful. I will discuss these reasons later in the chapter, when analysing the effectiveness of the intervention.

The two main reasons as to why students did not watch the videos were that they either did not need the help ("*Never got stuck*." – Sarah, Appendix H, line 224; "*Cos I didn't need to*." – Brian, Appendix H, line 353), or did not have the time ("*Most of the time I didn't have time to watch it*" – Mandy, Appendix H, line 513). One student admitted that he "*was too lazy"* to watch them (Kyle, Appendix H, line 149). Another student added that as well as not having the time, she also "*wanted to try without watching the videos. Try to do it myself*" (Mandy, Appendix H, line 513 – 514). Hayley, who had already claimed that she was too busy to watch the videos, seemed to have had a change of heart later in the interview, when she stated: "*Ya, I just thought no… basically, I don't know… I didn't really think about it that much. I think I basically more just forgot than actually did it. I just think ya, I genuinely forgot.*" (Hayley, Appendix H, line 606 – 608). As seen earlier in this chapter, Hayley already demonstrated that her answers could not always be trusted. It is difficult to believe that a student could have forgotten about the video tutorials, as the QR codes were printed on the homework worksheets, next to each question. For this reason I have decided not to include this as a valid reason.

The four reasons given are therefore (i) not needing help, (ii) not having time, (iii) being too lazy, and (iv) wanting to attempt the homework alone/without help. The first two were the most common, each mentioned by two students, so I will analyse these in more detail, but will first touch on the remaining two reasons.

If a student claims to be too lazy to do the work, then it is clearly a lack of motivation. To give some context to the situation, this student also admitted that he had made no effort to use the intervention ("*I was too lazy to download the app.*" – Kyle, Appendix H, line 78), and according to him, if he got stuck on a homework question, he "*left it*

out" (Kyle, Appendix H, line 165). Although motivation is certainly an issue that needs to be addressed, it is clearly particular to the student in question, and therefore not an adequate explanation as to why the majority of the students failed to watch the videos. Regarding the student who wanted to attempt the homework on her own, although an admirable aspiration, I had made it clear to all students that the videos were intended as a means of assistance should they get stuck on a specific question. One would therefore have hoped that if, upon attempting a question, she were to get stuck, that she would then make use of the intervention to help her complete the question. If she did not watch the videos, then one can assume that she did not get stuck or need assistance. This leads back to the common theme of not struggling or needing help. If students say that they do not struggle with the homework, it can mean one of two things. Either they understand the work and are able to complete the homework, or they mistakenly think they understand the work, but may be completing the homework incorrectly. If it is the latter, there is clearly a problem. I have collected data regarding students' marks and homework scores, and discuss these below with regards to use of the intervention. I also consider the Dunning-Kruger effect as a possible explanation for these results. However, before addressing this interesting turn of events, I will comment on the second recurring theme of why students did not make use of the intervention – a lack of time. I find this difficult to understand, as each video was not more than three minutes, and if the students were already busy with the homework, it would not have added much extra time to their routine. It would appear that these students either did not realise how long the videos were, or possibly that this seemed to them to be an adequate excuse for not using the intervention, but was not the actual reason.

It is interesting to note that none of the students felt as though watching the videos would have been cheating in any way ("*It's not like we're cheating cos it's not a test or anything like that, we're just looking for help.*" – Greg, Appendix H, line 317 – 318), and none was influenced by whether or not their friends watched. In fact, most did not even know whether or not their friends watched ("*Um, we don't really talk about it. I didn't even know if Greg had [watched the videos].*" – Sarah, Appendix H, line 262).

Also, and somewhat regrettably, it would appear that the parents, for the most part, did not do much in terms of encouraging the students to make use of the intervention. I had not asked any parents directly to get involved; however, when requesting consent in allowing their children to participate, I had made the design quite clear, and had even received feedback from more than one parent expressing approval of the intervention and saying they believed it was a great idea and wishing me luck with the study. I had hoped that parents would promote the use of the videos, especially if they were involved at all in their children's homework routine. Unfortunately, when students were asked during the interviews about their parents' thoughts on the intervention, most responded that "*they didn't really know*" about it (Greg, Appendix H, line 256; Phillip, Appendix H, line 473). This is discussed in more detail when highlighting and explaining the contradictions within the activity system.

As discussed above, a common reason given by the students as to why they did not watch the videos, was that they did not get stuck or need the help. In order to evaluate whether or not these responses were justified, I collected quantitative data including the students' term marks for Term 1 and 2, and used these as criteria for categorisation. Prior to the implementation of my intervention, I divided the students into two categories: "Need" and "No-Need". As the names suggest, I grouped the students so as to indicate which ones probably needed the extra help that the videos were intended to provide, and which ones seemed to be coping well enough with the work not to need the videos. The students who fell into the Need category were those who had achieved less than 60% for their Term 1 average, whereas those who had obtained 60% and above were placed in the No-Need category. These classifications were done without the knowledge of the students, i.e. students would not have known that they fell into a specific category, or even that the categories existed. I re-evaluated the students at the end of the second term, using their Term 2 averages, again without their knowledge. The above classifications are reflected in Table 4.5. There were a few changes from Term 1 to Term 2, and I have indicated these on the table. Students who moved from the No-Need category to the Need category are marked with a single asterisk, while those who have made the opposite transition (i.e. Need to No-Need) are marked with two asterisks.

Table 4.5: Comparison of Need v No-Need over Terms 1 & 2

Name	**Term 1**	**Term 2**
Brian	No-Need	No-Need
Fred	No-Need	No-Need
Greg	No-Need	No-Need
Megan	No-Need	No-Need
Mandy *	No-Need	Need
Hayley	Need	Need
Phillip	Need	Need
Kyle **	Need	No-Need
Sarah **	Need	No-Need
Legend: * = No-Need → Need ** = Need → No-Need		

As can be seen from Table 4.5, most students remained in the same category over both terms. Two students (Kyle and Sarah) improved, moving from the Need category to No-Need, while Mandy's marks dropped substantially, taking her from No-Need to Need. This meant that the number of students in the Need category decreased from four to three over the term, with two of the students in this category remaining constant.

Taking into account the usage data discussed above, I was able to further categorise the students within these two categories. I noted which students had not watched the videos ("Didn't Watch"), which students had watched a few of the videos ("Watched a Few") and which students had watched all of the videos ("Watched All"). These classifications are shown in the tables below. Table 4.6 reflects the initial categorisation, using the first term results, and Table 4.7 represents the revised categorisation at the end of the second term.

Table 4.6: Term 1 – Students' actual viewing of videos

Need			No-Need		
Didn't Watch	Watched a few	Watched All	Didn't Watch	Watched a few	Watched All
Kyle Sarah Hayley	Phillip		Brian Greg Mandy		Fred Megan

Table 4.7: Term 2 – Students' actual viewing of videos

Need			No-Need		
Didn't Watch	Watched a few	Watched All	Didn't Watch	Watched a few	Watched All
Hayley Mandy	Phillip		Kyle Sarah Brian Greg		Fred Megan

A very interesting observation, common to both Table 4.6 and Table 4.7, is that the block containing those students who needed to watch the videos (Need) and actually watched them (Watched All) is empty. Although one of the students who needed to watch did watch a few of the videos ("*Not many. Like the things I didn't understand obviously I watched.*" – Phillip, Appendix H, line 424), none of the students in need made full use of the videos. In Term 1 there were four students who needed to watch the videos. Of these four, three of the students did not watch any, and one of them (Phillip) watched a few. Of the five students who did not need to watch videos, three of the students did not watch any, and two of them watched all of the videos. In Term 2 there were three students who needed to watch the videos. Of these three, two did not watch any, and one (Phillip) watched a few. Of the six students who did not need to watch the videos, four did not watch any, and two watched all of them. Fred and Megan were the only two students to watch all the videos, and in both Term 1 and 2

they fell into the No-Need category. Over the first two terms Kyle, Sarah, Hayley and Mandy needed to watch the videos, but none of these students watched any of them.

Mandy was in the No-Need category in Term 1, and in the Need category in Term 2. She stated that she did not watch the videos because she did not have enough time, and also because she wanted to try to answer the questions by herself, without getting help (Appendix H, line 513 – 514). She also stated that she did not struggle with the homework ("*No, it's usually easy*" – Mandy, Appendix H, line 526). Although in the first term this might have been the case, in the second term it certainly was not, judging by her term mark. So Mandy was not able to recognise when she did not understand, or was struggling with the work.

4.3.1.1 Teacher Feedback Forms

The TFFs documented how much of the homework students attempted each day as well as how much of the attempted homework was answered correctly. I also made note of any useful or interesting findings. The original intention was to use these forms as a way of observing whether watching the videos could lead to an improvement in homework completion. However, seeing as the majority of the class did not watch the videos, the only useful data in this respect would be the forms of the two students who watched the videos regularly. These are analysed and discussed in the next section, which addresses the question of whether the videos were beneficial. The rest of the forms proved to be of use in identifying which students struggled with the homework and therefore should have made use of the videos. This could possibly offer a more accurate picture than the marks from Terms 1 and 2, as the term marks are based solely on the two tests, in the case of Term 1, or exams, in the case of Term 2, as well as an assignment which is also completed at school. A term mark is therefore not necessarily an ideal criterion for judging whether or not a student is struggling or requires assistance. For this reason I include the information from the TFFs to supplement the results obtained from the term marks.

The TFFs made use of a rating scale from 1 to 5. For completion, 1 would indicate that little to none of the homework had been completed, and 5 would indicate that all of the homework had been completed. The mark for correctness indicated how much of

the completed homework was correct, with 5 signifying that it was all correct. In order to observe both of these factors together in a meaningful way, I created the Overall Completion of Homework Indicator (OCHI) as a single variable with a percentage value. The OCHI is calculated as a function of both the degree of completion and the correctness of homework completed, using the formula:

$$f(x,y) = 4xy \qquad \textit{for } 1 \le x \le 5 \textit{ and } 1 \le y \le 5$$

I devised this formula so as to take both factors into account, and provide an overall percentage indicating how the student fared with each homework assignment. The OCHI can range from 4% (no homework attempted) to 100% (homework complete and correct). As I am particularly interested in whether or not the students who felt that they did not struggle actually understood the work, I have calculated the OCHIs of these particular students over the period of the intervention, and display these data in Figure 4.1 below. An average was calculated for each week, and these four averages, over the four weeks of the intervention, are plotted. From the graph, it is clear that of the five students (Brian, Greg, Kyle, Mandy, Sarah) who claimed that they did not struggle with the homework, and did not watch the videos on a regular basis (if at all), at least two of them were not performing well enough to support these claims. Kyle and Mandy consistently had scores below 70%; for a test result this could be considered a good achievement, but from a homework perspective, where students are expected to complete the work correctly, this is markedly low. This suggests that these two students were in need of assistance with completing the homework, implying that they should have watched the video tutorials. Greg's score for two of the weeks also fell below 70% (weeks 2 and 3), and even Sarah has a score of just 64% for the final week. In fact, Brian is the only one of these students whose OCHI remained consistently high throughout the intervention, at 80% or above, indicating that his homework was, for the most part, fully and correctly completed, and confirming his statement that he does not struggle with the homework. For the remaining four students, however, it is clear from the results presented in Figure 4.1 that they all performed poorly during at least one of the weeks, possibly more. For these students to tell me that they do not struggle with the homework, but then fail

to complete all of the homework (or complete it correctly) on a regular basis, indicates an incongruity between what the students say and believe, and the reality of the situation. This also supports my assertion that students are not always capable of determining when they are struggling or do not understand the work.

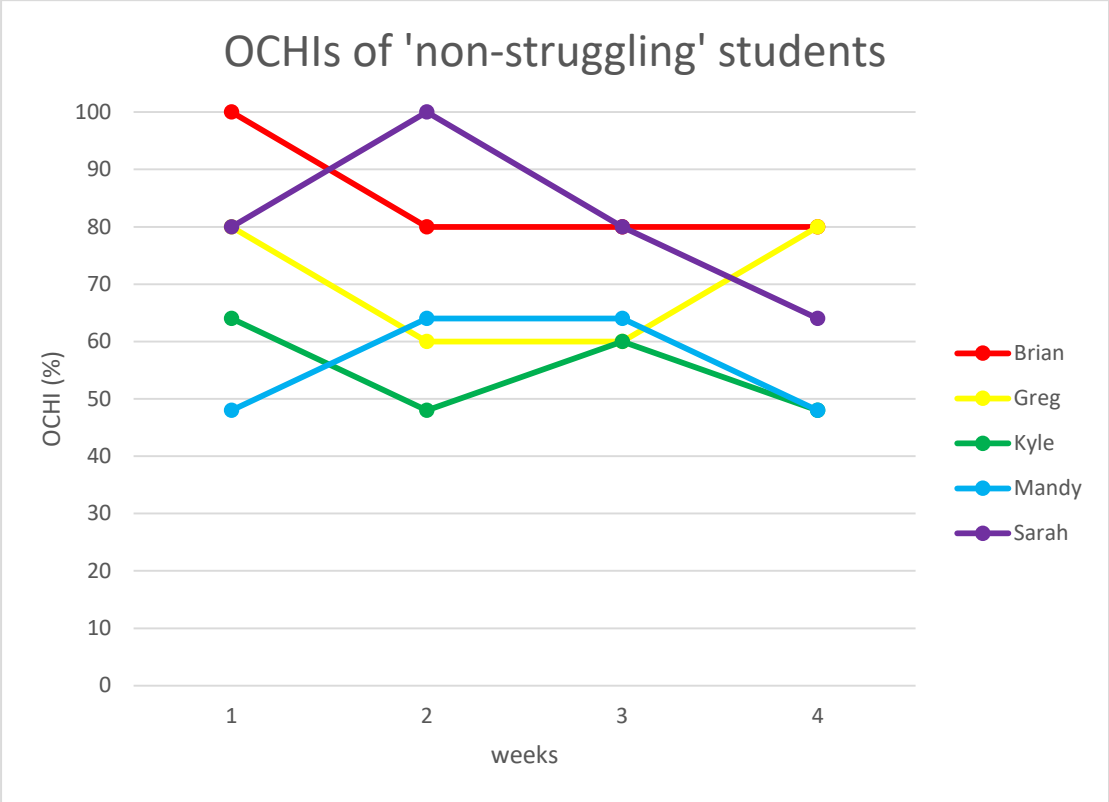

Figure 4.1 OCHIs of 'non-struggling' students

I used the 'Comments/Notes' column on the TFF as a way to (i) include necessary explanations about specific results, and (ii) make a note of any interesting or significant findings. Some of these notes add insight and provide greater understanding in regard to certain results. For example, it was noted that Mandy had made a mistake in one of the questions, which could, and would have easily been avoided had she watched the corresponding video. Similar comments applied to other students.

These findings are interesting as it shows that the very students at whom the intervention was aimed did not utilise it. And it would appear that this was mainly because they felt (incorrectly) that they did not need the extra help. This phenomenon

is not uncommon. In fact, as discussed in Chapter 2, Kruger and Dunning (1999) found, in a study, that when faced with assessing one's ability in a specific skill, those falling into the bottom quartile tend to have an inflated view of their ability. The occurrence also held true for the 2nd and 3rd quartiles, though to a lesser degree. This is due to the fact that their lack of ability leaves them unable to evaluate their, or anyone else's ability in the skill in question (Kruger & Dunning, 1999). The Dunning-Kruger effect can be used to explain the results of the intervention. The data indicate that the majority of students did not utilise the intervention because they felt they did not need the assistance. Of the nine students participating in the study, only three admitted to occasionally struggling with their homework (Phillip, Appendix H, line 436; Fred, Appendix H, line 116; Hayley, Appendix H, line 644 – 645); the majority claimed that they rarely, if ever, struggled (Megan, Appendix H, line 16; Sarah, Appendix H, line 230; Greg, Appendix H, line 232; Brian, Appendix H, line 357; Mandy, Appendix H, line 526), and one student said that he did not do most of the homework ("*I didn't really do it [the homework]*" – Kyle, Appendix H, line 157). However, of the students who indicated that they encountered no problems when completing the homework, two appeared in the Need category over the two terms. This would suggest that the students were unable to recognise that they did not understand the work, and therefore did not make use of the available assistance (namely, the videos). This is a difficult issue to address, as the students must be made aware of the fact that they do not understand the work; however, at the same time, it is important not to make them feel inadequate. I discuss possible solutions to this problem in Chapter 5.

4.3.2 To what extent does the use of the video tutorials improve the students' understanding of the concepts?

In order to conclusively ascertain whether or not the videos were able to improve the students' understanding of the work, an in-depth quantitative analysis would be required along with the qualitative data collected. As Jacobson (2006) advises, quantitative analysis of results is necessary, because students cannot always be trusted to give accurate evaluations of the usefulness of the intervention. They often believe it has helped them, whereas test scores indicate no improvement. Unfortunately such an analysis was not within the scope of this study. The quantitative

data collected will be presented and discussed; however, one cannot draw any definitive conclusions from these results.

Due to the fact that only two students made regular use of the videos, the possibility of obtaining meaningful data regarding the effectiveness of the intervention is further diminished. Two students are clearly not enough to be able to establish any noticeable trends or correlations. I therefore note and discuss my findings, but keep in mind that no definite conclusions can be drawn.

When the students who had watched at least one video were asked what they found most helpful or valuable about the videos, the most common answer was that they were well explained (Fred, Appendix H, line 99; Brian, Appendix H, line 348). This is, of course, a pre-requisite for such a video – the aim of the intervention was to help students understand the work, so a video which did not adequately explain the concept would be of little value. A student also noted that the videos "*used easy examples*" (Fred, Appendix H, line 99). While I did not specifically choose easy examples for the videos, I did choose examples which I felt clearly helped to explain the concepts. Another student said that she liked that the videos gave a single method of how to solve a problem ("*Well that it… there was only one way of doing it… and it gave it to us like that*" – Megan, Appendix H, line 25 – 26). Students are welcome to use various methods of solving problems, provided they are mathematically correct, and I do not force students to use a particular method. I do, however, realise that my students can quickly become confused if I demonstrate too many alternative ways for solving a problem, so I tend to initially show some of the different methods available, but then stick to the one that most students feel comfortable with. Although in the videos I may have used just one method when explaining the examples, I had not expected nor intended the students to take this to mean that there was only one way of working out the answer. This is something that should certainly be considered in the future, as one needs to find a balance between limiting students' choices on the one hand, and overwhelming them with information on the other. Another comment was that the most valuable thing about the videos was the fact that they were "*visual*" (Phillip, Appendix H, line 444). This was also an unexpected response, although on

reflection a very important one. Without the visual aspect, the videos would have been extremely difficult (perhaps even impossible) to follow. One of the reasons I chose the technology I did, was for the affordance of watch-ability (Bower, 2008), and I specifically used a virtual whiteboard app so that I could explain the concepts as I would in the classroom. I am glad that at least one student noted this, otherwise I might have overlooked this crucial aspect.

A student who did not watch the videos, as she did not feel she needed the help, still offered some positive feedback in the form of an analogy: "*Also, the final answer wasn't in the videos if I'm correct.*" [No, well that was the point. It didn't give you the answer, it told you how to find it.] "*Exactly. So it shows you how to catch the fish, it doesn't give you the fish.*" (Sarah, Appendix H, line 325, 330).

I asked the students who watched the videos for any feedback on ways to improve the intervention. I also asked the students who did not watch the videos for any improvements they could think of, which might have made them more likely to watch the videos. Of the students who watched the videos, only one provided feedback. She suggested that I "*make it a little more smoother, maybe put some animation in*" (Megan, Appendix H, line 62 – 63). This is something which one could keep in mind for future interventions (as an animated video would probably hold a student's attention for longer). However, this was certainly not a major issue, and did not detract from the actual watch-ability of the video, or the video's ability to get its message across. Three of the students who did not watch the videos gave me their ideas for possible improvements to the intervention. Firstly, a student suggested that "*it be on YouTube*" (Kyle, Appendix H, line 202). He was surprised to learn that the videos were in fact on YouTube. This was one of the students who had not downloaded the app to scan the barcodes. It is difficult to make sense of his feedback; I find it hard to believe that, had he known the videos were on YouTube, it would have made any difference to his decision not to watch them. Another student suggested that I should have shown them a video in class, and explained how to use the intervention ("*Also, if you gave it to us… if you showed it to us… in class. If you showed it to us and how to use it…*" – Greg, Appendix H, line 283 – 284). I did do this on the day before the intervention

commenced, by showing them how to scan a barcode using the app, which took them to an example video. I can only assume that this student was not in class on that day. This student also said that it would have been better to have shown one of the actual tutorial videos as an example video, so that the class could get an idea of what to expect from the videos ("*Ya, and also, um, a lot of these… like you think of something like this to be very cheesy, and then, like… I'm not saying that yours are cheesy… but usually people won't go into it because it's such, like… they don't feel like doing it or like Kyle, they're too lazy… but maybe if you showed it to us… and I'm sure yours was very nice, so if you showed it to us in class and we actually saw that… it wasn't as cheesy as some of them, then we would have made an effort…*" – Greg, Appendix H, line 294 – 299). This is certainly something to consider for future implementation. The third student also had a valid suggestion, which was that the videos be available on a flash drive rather than having to watch them on the internet ("*Maybe if we didn't have to download them off the internet or watch them on the internet. Maybe if we could have them on a flash drive or something like that*" – Sarah, Appendix H, line 270 – 271). She explained that she did have the facility to watch them online, but would have preferred to have had her own copy. This is certainly worth considering for future interventions.

Both Megan and Fred attempted all questions on homework assignments, and both would get on average 80% correct. I have calculated their OCHIs over the period of the intervention, and this is represented below in Figure 4.2.

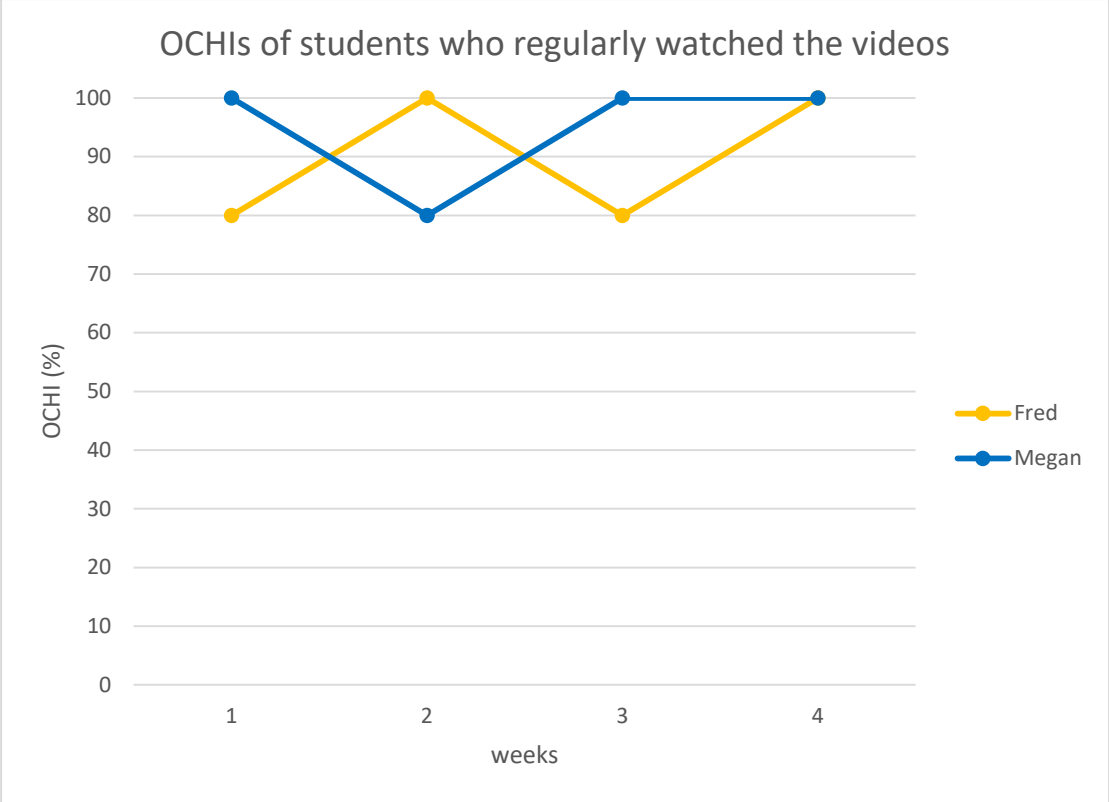

Figure 4.2 OCHIs of students who regularly watched the videos

As can be seen from the graph, their scores were relatively consistent throughout the entire intervention, and although they are also both reasonably high in comparison to the rest of the students (Figure 4.3), this cannot be assumed to be due to the video tutorials, as neither was at any point in the Need category, suggesting that they may not have needed the assistance that the videos provided. They never showed any signs of struggling; it is therefore difficult to ascertain whether the videos had substantially improved their understanding of the work. For this reason, these quantitative data do not allow for much insight into the helpfulness of the videos, which is why I have also relied on the qualitative feedback from the students.

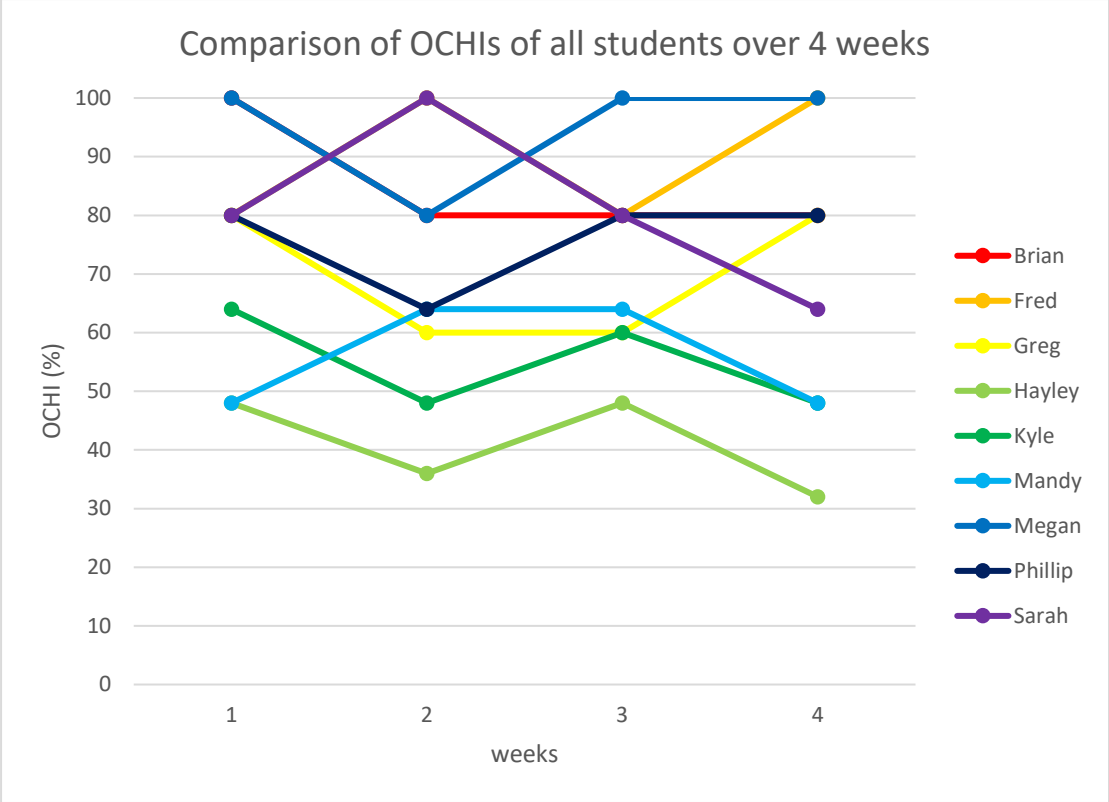

Figure 4.3 Comparison of OCHIs of all students over 4 weeks

4.3.3 What constitutes a suitable homework environment and does this coincide with students' perceptions of a suitable homework environment?

In Chapter 2, it was concluded that a suitable homework environment is not a simple concept to define. Studies investigating what factors contribute to such an environment have found that they vary with the learning styles of the students (Hong et al., 2004; Hong, 2001; Hong & Lee, 2000). Does this imply that students have a better idea of the conditions in which they should be completing their homework than their teachers and parents? It is possible that teenagers may not be mature enough to make insightful choices regarding these issues. In order to gain some insight into students' perceptions of suitable homework environments, I included two pertinent questions in the questionnaire. The first question, asking the participants to describe the space where they do their homework, was fairly straightforward. The next question, however, required a more complex answer. The students were asked whether they would consider this to be a suitable space, and why.

Before discussing the students' responses, it is important to note that the scope of this study was not sufficient to provide a definitive answer to this research question. The analysis which follows highlights certain trends, and I comment on the students' perceptions of a suitable homework environment.

Five of the students responded that they complete their homework at a desk. I would certainly consider this a suitable space to work; it is, after all, where they work for most of their classes at school. I was, however, interested in their answers to the second question. Of these five students, all stated that this was a suitable homework environment. Reasons given included that it is peaceful, that it is an easy place to work, and that it is quiet and without distractions. One of these students added that she sometimes listens to music while completing her homework, explaining that it is "*calm and chilled.*" All of these reasons indicate a good perception of what is suitable, especially understanding the need to eliminate distractions (Ramdass & Zimmerman, 2011).

One student answered that he does his homework in his room, another specifying that he works at the dining room table. Both of these students felt that their spaces were suitable, both for the reason that it was a quiet environment. This certainly seems to be a recurring theme among the students. A third student responded that he does his homework at school, in either the library or the learning centre. He, too, mentioned that it was quiet, when justifying why it is a suitable space, as well as noting that there is help available, should he need it. Again, the students are demonstrating a mature understanding of what contributes to a good homework environment, taking into account factors that contribute to suitability.

The final student stated that he does his homework on his bed. In response to the second question, he wrote: "*It is for me, I feel that I work a lot easier when I'm comfortable.*" Whereas a bed may possibly be considered an unsuitable place for doing homework, due to the lack of a solid surface to write on, the student's explanation allows some insight into his understanding of his own learning style. The fact that he answers the question by emphasising that he feels it is a suitable

environment for himself, rather than a generally suitable environment, is consistent with Hong and Lee (2000), who found that different students work best under different conditions. Mentioning that he works best when comfortable, reveals an appreciation of the factors conducive to his own working environment.

4.4 Analysis of the activity system

When evaluating an intervention through an Activity Theory lens, it is necessary to observe the interaction between the various elements, as well as any contradictions. These contradictions help to better explain the observed outcome, as well as identifying areas that need to be addressed. I now review the research questions with respect to the theoretical framework, paying special attention to any contradictions.

4.4.1 To what extent do students make use of the available technology to complete their homework?

As discussed in Chapter 2, the students participating in the study are the subject of the activity system, and the object they are acting upon is the Mathematical Literacy curriculum, specifically the three topics chosen for the study. The tool is the combination of video tutorials and QR codes, which were implemented so as to mediate the students' learning. From the results it is clear that the desired outcome of the tools mediating the students' learning of Mathematical Literacy has not been achieved, indicating that there are contradictions within the system. There is no observed contradiction between the subject and the object; this is the prescribed curriculum which is taught and tested. There is also no contradiction between the object and the tools; the content was clearly and effectively explained using video tutorials, with students confirming the helpfulness of the videos. The videos were also easy to create, in terms of explaining the concepts, verifying that the tools lent themselves well to the object (Mathematical Literacy content). The contradictions therefore lie elsewhere in the system. The results have shown that most of the students did not make use of the intervention when completing their homework; this points to a contradiction between the subject and the tools, as shown by the orange dotted line in Figure 4.4 below. This contradiction is significant as the entire intervention revolves around the students' use of the technology. The challenge is

therefore to find a way to encourage the students to use the tools provided. This is further discussed in Chapter 5.

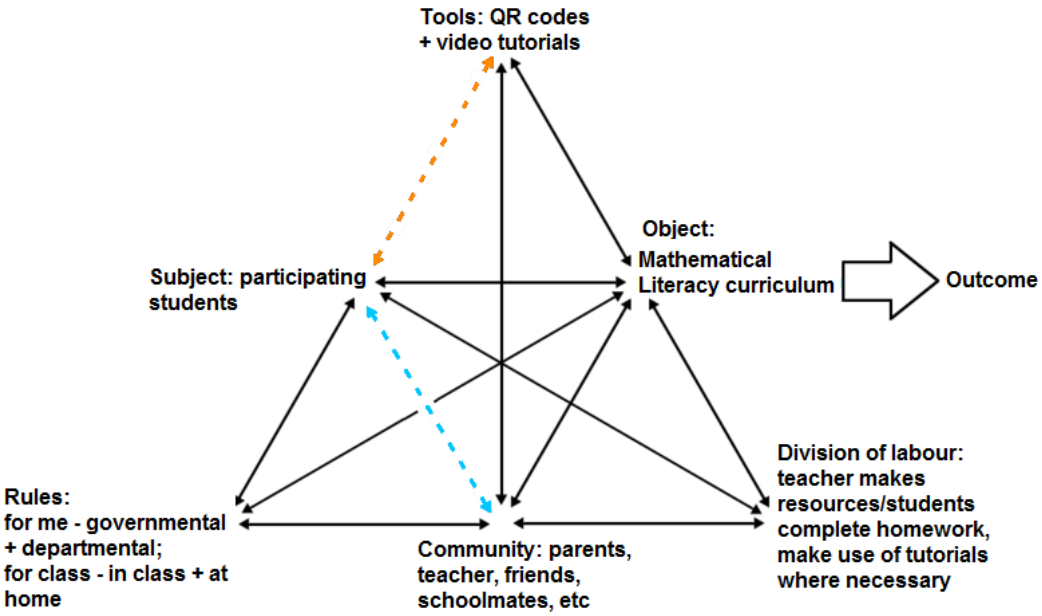

Figure 4.4 Contradictions within the activity system

The rules of the system are the classroom rules regarding homework and completion of homework, as well as rules at home governing under what conditions students can complete their homework. There is no observed contradiction between the subject and the rules; the students completed their homework as per usual. These rules had been in place for some time before the implementation of the intervention. A potential contradiction between the rules and the tools could have arisen had the students not been allowed to have their cellphones near them while completing their homework. However, none of the students mentioned this as an issue during the post-intervention interviews. Had the contradiction been identified, it would have been necessary to contact the parents and request that they allow their children to have a mobile device nearby during completion of Mathematical Literacy homework.

The community includes the remaining non-participating students in the class, as well as school friends, parents and siblings. When considering the community, there are observable contradictions between both the subject and the community, as well as

potentially the tools and the community. Students explained in the interviews that the opinions of their peers had no bearing on their decision to watch or not watch the videos. However, in terms of the parents, one would hope that parents would be involved in their children's homework routine, meaning that they would at least acknowledge the intervention and possibly encourage their children to make use of it, or try it to see if it could be of assistance. If parents did not know about the intervention, as the students alleged, they would not have been able to look at one of the homework worksheets without noticing the QR codes, suggesting that parents are not sufficiently involved in their children's homework routines. Conversely, had the parents known about the intervention, but chosen not to mention it or encourage their children to make use of it, there would be a contradiction between the community (specifically the parents) and the tools. It would then be necessary to meet with these parents in order to better understand this contradiction. Considering that the parents of all of the participants had given consent for their children to participate in the study, with some even commenting that they believed the intervention was a good idea, it would appear that the issue does not lie in the parents' attitude towards the technology, implying that there is no contradiction between the community and the tools. The contradiction is therefore between the subject and the community, as illustrated by the blue dotted line in Figure 4.4.

For the division of labour, my job is to create the video tutorials and worksheets with QR codes, while the students must complete their homework, making use of the intervention if they so desire. There is no observed contradiction between the subject and the division of labour, as the students are not forced to use the intervention, they are required only to complete their homework, as per usual. This is therefore unaffected by the introduction of the intervention.

4.4.2 To what extent does the use of the video tutorials improve the students' understanding of the concepts?

In terms of evaluating the usefulness of the video tutorials, those students who watched the videos claimed that they were beneficial in assisting them in understanding the work and completing their homework. There were no observed

contradictions within this system. Although regular use was not made of the intervention, the tools were recognised as having been useful in assisting the students with their understanding of Mathematical Literacy concepts.

4.4.3 What constitutes a suitable homework environment and does this coincide with students' perceptions of a suitable homework environment?

The students have shown a mature understanding of the necessary factors contributing to a suitable homework environment for them specifically, displaying insight into how the particular surroundings are conducive for them. Two apparent contradictions which could arise within this activity system would be between the object and the rules as well as the object and the community. The rules of the system, governing how, when and where the students complete their homework, could potentially conflict with the factors necessary to provide a suitable homework environment to the students in question. In this situation, students may not be able to complete the homework to their best ability, or as easily as they might have been able to if working in a different environment. Alternatively, a contradiction could exist between the object and the community, if members of the community, such as parents, or possibly friends or classmates, influence the students' homework routines. Again, this could result in homework being completed in a suboptimal environment. From the results it would appear that these contradictions did not arise, as all students described their homework environments as suitable, justifying their responses with reasons as to why.

4.5 Comparison to prior research

From the results it is possible to tentatively conclude that the intervention may be capable of mediating learning. This is in accordance with the findings from the previous studies discussed in Chapter 2 (Kim, 2009; McCabe & Tedesco, 2013; Boster et al., 2007; Ellington & Hardin, 2008; Mendicino et al., 2009; Nurre & Sharkey, 2013). In contrast to some of the prior research, is the fact that the students did not make regular use of the intervention. Kalloo and Mohan (2012) found that most students responded positively to their intervention (a mobile app), noting that the games section was utilised the most. This could suggest that adding an element of

gamification, or fun, to my intervention may encourage the students to make more frequent use of it. One of the videos that I created was a "maths joke[10]" instead of a tutorial, and I placed it on a worksheet in an attempt to encourage students to watch the videos. In place of a question, the barcode was introduced with the words "MATHS JOKE". This video was in fact viewed a number of times, indicating that making the intervention more entertaining could possibly increase usage.

4.6 Conclusion

This chapter began with a clearer description of the context of the study, through analysis of the pre-intervention questionnaire responses as well as the focus group data. The remaining data were then analysed and discussed with regards to finding answers to the subsidiary research questions. The activity system was also examined and contradictions were identified and explored. The results of the study were compared with those of prior research, highlighting similarities and anomalies, and finally, the overall research question was reviewed, and responded to as best as possible.

[10] https://www.youtube.com/watch?v=VBH4mze6pNo

5 Summary and Recommendations

5.1 Introduction

In this final chapter, I review the findings and summarise the important and significant findings, as well as the conclusions which were drawn, tentatively or otherwise. Looking at each of the subsidiary research questions in turn, I then use these findings to attempt to answer the main research question of this dissertation. In closing, I discuss the limitations of the study as well as recommendations for further research.

5.2 Summary of research questions

5.2.1 To what extent do students make use of the available technology to complete their homework?

The intervention was designed as a means of helping students who were in need of assistance. However, from the findings it is apparent that students did not make much use of the technology. This was due to a number of reasons, the most common – and interesting – being that students were unable to recognise that they needed assistance. Although no student was averse to the concept of the intervention, most stated that they would watch the videos only if they were struggling with the homework, with the (often incorrect) belief that they were not struggling. The research revealed that the students most in need of the intervention simply did not utilise it, as they were lacking not only ability in Mathematical Literacy, but also the skills required for assessing their lack of ability. They therefore did not (and could not) realise their weakness in the subject, and so did not feel that it was necessary to watch the video tutorials.

Conversely the students who did make use of the intervention were the ones who were already performing well in the subject. While I am certainly pleased that the videos were watched by the higher performing students, it is of concern that the majority of the class, including the weakest students, did not watch them. The challenge therefore lies in helping students to acknowledge their limitations, in order to enable them to seek assistance. However, as Dunning et al. (2003) point out, in order for students to be able to acknowledge their limitations, they would require the

skills necessary to transcend these limitations in the first place. This paradox serves to further complicate the situation, suggesting that it may be necessary for the teacher to intervene to break out of this vicious circle.

5.2.2 To what extent does the use of the video tutorials improve the students' understanding of the concepts?

Due to the small sample, and even smaller number of students who watched the video tutorials, coupled with the fact that the intervention ran over a relatively short period of time, it is not possible to quantitatively rate the effectiveness of the intervention. A more in-depth, longitudinal study would be required to conclude whether the intervention has any significant effect on a student's understanding of Mathematical Literacy concepts. This would involve carefully structured testing and monitoring of results over a longer period of time. Additionally, a much larger sample would be necessary, preferably representative of the population of South Africa.

Although no concrete conclusions can be drawn based on quantitative data, it is useful to consider the feedback from the students who utilised the intervention. All of these students commented that the videos were helpful, both in understanding the concepts and completing the homework. Jacobson (2006) warns against accepting students' opinions on the usefulness of interventions without taking test scores or other relevant quantitative data into account, as they are not always able to accurately assess whether or not the technology has benefitted them. Clearly further testing is necessary in order to evaluate the effectiveness of the intervention, but considering the positive feedback of the students who did make use of it, these being relatively high performers, I do feel that it is worth investigating further, as it may well prove beneficial to struggling students, if they can somehow be persuaded or encouraged to use it. The results have not in any way shown that the intervention did not help, I therefore conclude that the intervention may well assist students in completing their homework and in understanding the relevant concepts, but that additional research is necessary in order to confirm or refute this claim.

5.2.3 What constitutes a suitable homework environment, and does this coincide with students' perceptions of a suitable homework environment?

It was concluded that a suitable homework environment is difficult to define, and as mentioned in the previous chapter, this study did not enable me to fully answer the question. Students differ in their learning preferences, which in turn prescribes different environments for working and completing homework. Although certain factors are considered to be necessary in describing a suitable homework environment, such as a lack of distractions, others are dependent on the individual student's preferences.

The participants in the study demonstrated an accurate perception of a suitable homework environment, in terms of their own unique needs. Not only did they complete their homework in spaces suited to their respective individual requirements, but they showed an understanding of why these spaces were suitable and conducive to working. Noting factors such as quietude and comfort, they seemed able to identify their optimal environment. They also recognised, possibly intuitively, that these factors varied from student to student, explaining why the environment they described worked for them specifically, whether it involved comfort, quiet, or social interaction.

5.3 Limitations of the study

This research was limited by the sample size and short duration of the study. Due to the small number of participants, it was difficult to identify any conclusive trends or relationships. The time frame was also too short to note any significant changes in students' marks and attitudes. Another important point is that the research was conducted at a private school; the sample was therefore not a true representation of the population, namely, all Mathematical Literacy students in South Africa. A further limitation is that the study did not provide for extensive quantitative data collection, meaning that conclusions were based mostly on qualitative data. The qualitative data did prove extremely useful in considering and analysing students' fairly terse responses; however, as mentioned before, quantitative data would be necessary in supporting whether or not the intervention was of use.

5.4 Conclusion

Although the intervention was not as effective as I had hoped, these results certainly do not disprove its potential effectiveness. However, further research will be necessary in order to draw definitive conclusions.

To ensure that students make use of the intervention, two strategies are suggested. Firstly, watching the videos could be made compulsory. This negates the Dunning-Kruger effect in that it no longer matters whether or not students think they understand the work; they are required to watch the video regardless. A second strategy would be to incentivise watching the videos. Students could be rewarded for submitting correctly completed homework assignments. In order to ensure that their homework is correct, students might be encouraged to watch the video tutorials. Whilst not completely negating the Dunning-Kruger effect, this would possibly diminish it.

5.5 Recommendations for further research

As mentioned above, I would recommend a more extensive study to test the effectiveness of the intervention. It is also perhaps worth investigating whether students in other subjects would be more inclined to utilise the intervention. For example, if this study were to be done using Mathematics students, rather than Mathematical Literacy, would the outcome be any different? Intuitively, I posit that the intervention would be better utilised by Mathematics students, and recommend that further research is undertaken in this line. From my experience, Mathematics tends to be a more competitive subject than Mathematical Literacy, with students often comparing marks, resulting in weaker students being made more aware of what Kruger and Dunning would term their 'incompetence'. Also, in many schools Mathematics classes are streamed by ability, making it easier for students to discern their level of ability. Regardless of subject, however, I recommend making use of an appropriate strategy, in order to ensure that the videos are watched by as many participants as possible. It will be interesting to see what this further research will reveal. As stated above, I remain cautiously optimistic that this is a potentially beneficial intervention.

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Different types of graphs

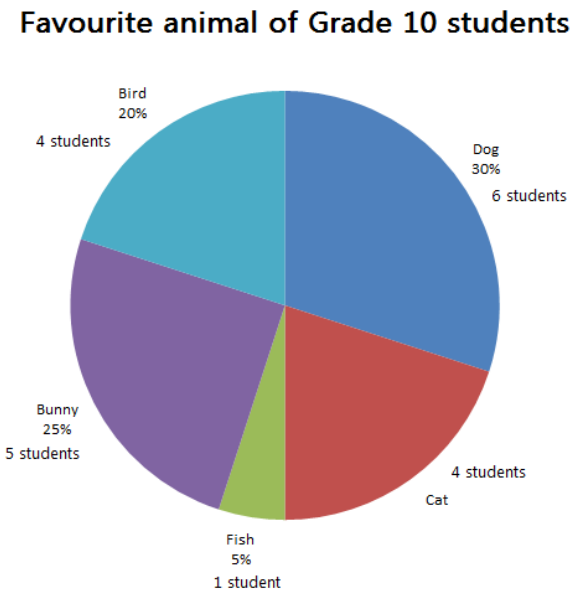
1. Favourite colour of Grade 10 students

Colour	Number of students
Blue	☺☺☺☺☺☺☺☺
Green	☺☺☺☺☹
Red	☺☺☹
Purple	☺☺☺☺
Yellow	☺☺
Orange	☺☺☺

☺ = 4 students

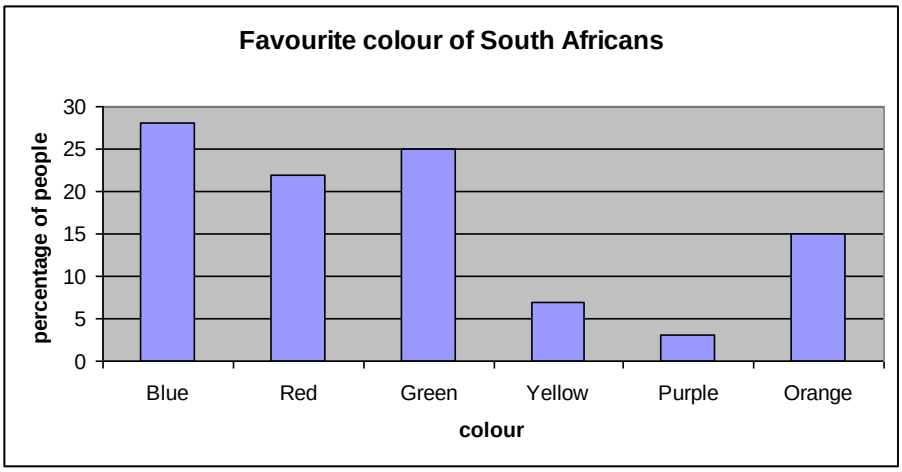
a. What type of graph is this?
b. How many students chose green?
c. What does a ¾ smiley represent?
d. Which is the least popular colour?

2.



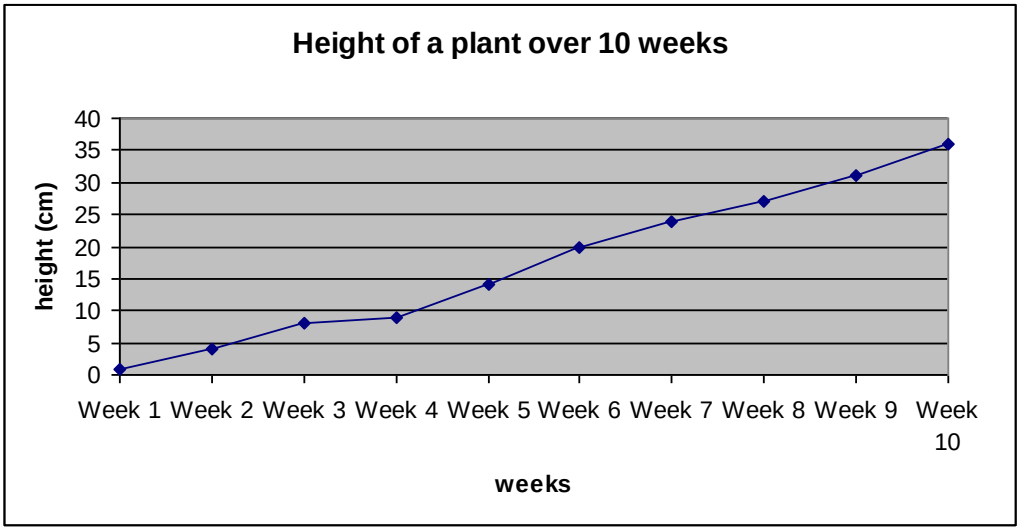
a. How many people were interviewed in total?
b. What percentage of people chose cats?
c. Which is the most popular type of animal?
d. What fraction of people chose bunnies?

3.



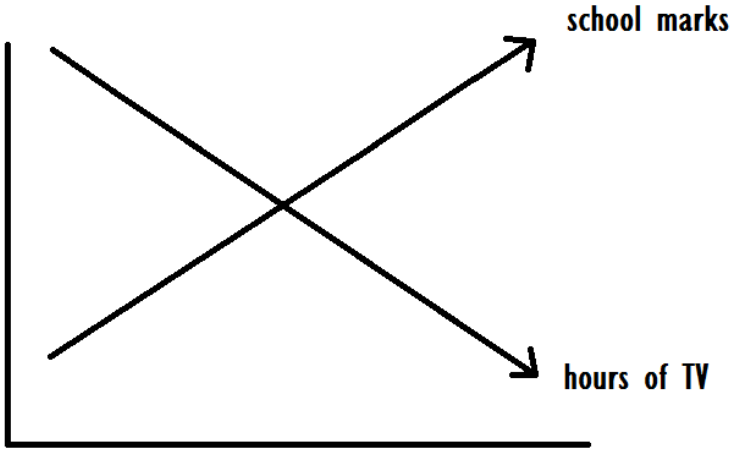
a. Which is the least popular colour?
b. What percentage of people chose Green?
c. What percentage of people chose Red?
d. Can you tell from this graph how many people were interviewed in total? Why/why not?

4.



a. Between which two consecutive weeks was the biggest growth spurt?
b. What was the height at week 2?
c. What was the height at week 10?
d. Between which two consecutive weeks was the smallest growth spurt?
e. Why is the graph increasing (going up) and not fluctuating (going up and down)?
f. What is the dependant variable?

5.



a. What does this graph show?
b. Why is there no scale?
c. Is it accurately drawn? Why/why not?
d. Do you agree with this graph? Why/why not?

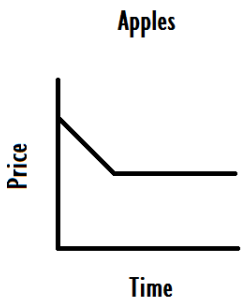
6.

a. What is this graph telling us?
b. What does the hundred Rand note getting bigger represent?
c. Does this graph have a scale?
d. Is this an accurately drawn graph? Why/why not?

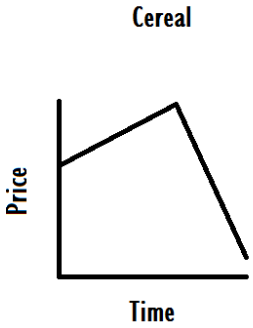
Shape and Direction of Graphs

1. Write a sentence explaining what happens to the price of each item over time.

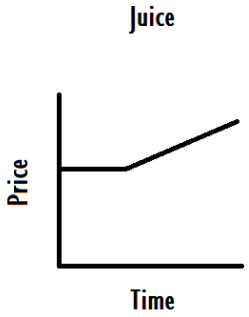
a.



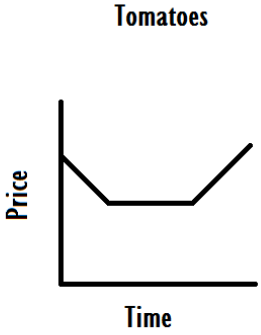
b.



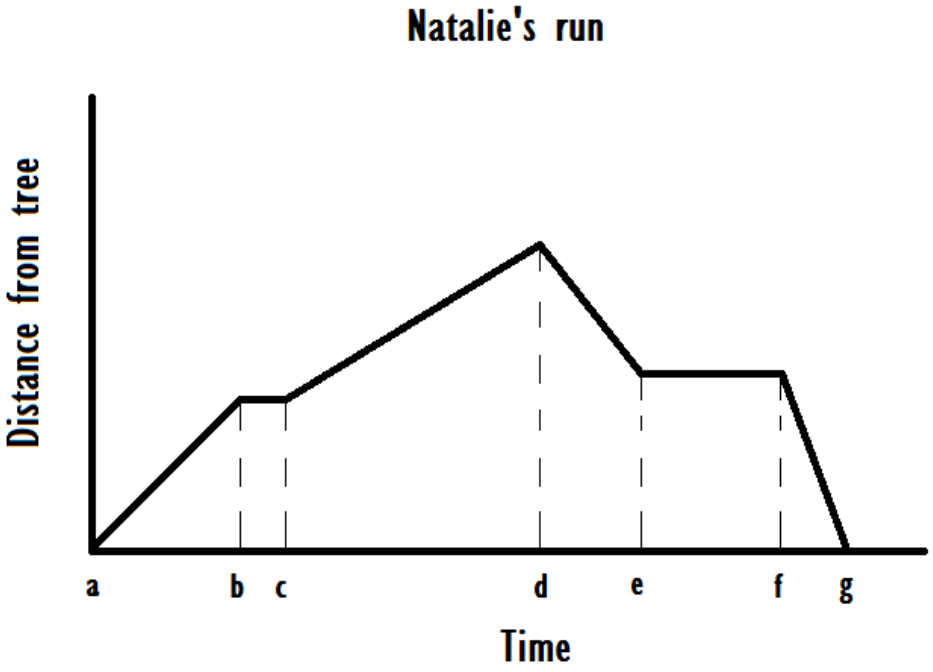
c.



d.



2. Natalie wants to go for a run. She decides to run from a tree that she is standing next to, to a rock far away, and then back again. The graph below shows this trip.



a. Where is Natalie at time a?
b. At what time does Natalie reach the rock?
c. When is she running her fastest? How do you know?
d. When is she running her slowest? How do you know?
e. What could have happened between time e and f? Give a reason for your answer.
f. Did Natalie take longer to run to the rock or to run back again? How do you know?
g. Describe Natalie's run from start to finish.

Filling in and generating tables

1. Complete the following tables by finding the values of A and B:

a. The cost for a handyman is R135 per hour.

No. hrs	1	3	4	**B**	8
Cost (R)	135	**A**	540	675	1080

b. A video shop charges a R25 subscription fee plus R7 per video taken out. Use the formula **Cost = 25 + 7 x number of videos**.

No. videos	1	2	3	**A**	9
Cost (R)	32	39	46	67	**B**

c. Every 2 minutes Jessica runs 280 metres (Hint: work out how far she runs every minute).

No. min	10	20	50	**B**	110
Distance (m)	1400	**A**	7000	9800	15400

2. Draw a table to represent the first five terms in each of these relationships.

a. A printing company charges 25c per page.

b. A gardener charges R45 per hour.

c. A parking official charges R5,50 per half an hour.

d. To rent a bicycle it costs R150 plus R12 per hour.

e. To rent a bus it costs R600 plus R22 per person.

f. To hire a venue for a function it costs R14 000 plus R130 per person.

Measuring mass

1. Do the following calculations and give your answer in
    a. The smallest measuring unit
    b. The biggest measuring unit

    a. 250g x 3 + 3kg
    b. 1000mg ÷ 5 + 20g
    c. 4kg + 400g ÷ 20
    d. 500g + 350mg x 5 + 2kg
    e. 6000g – 4kg ÷ 2
    f. 25mg x 120 – 26g ÷ 13

2. The following ingredients are part of a lasagne recipe that serves 8:

    - 2 tablespoon olive oil
    - 2 onions
    - 5 cloves garlic
    - 500g beef
    - 1/3 cup milk
    - 1 cup red wine
    - 800g tomatoes
    - 3 tablespoons tomato paste
    - ¼ teaspoon black pepper
    - 100g grated cheese

    Adjust the quantities of the ingredients so the recipe can serve
    a. 4 people
    b. 12 people

3. A garden needs 0,5kg of fertilizer per m^2. How much fertilizer would you need if the garden was
    a. $10m^2$
    b. $25m^2$

4. You go to a buffet where they weigh your food and charge you per kg.
    a. Pasta costs R120/kg. If you eat 180g of pasta how much do you pay?
    b. You pay R42 for 210g of fish. What is the price per kg?

Volume and Temperature

1. You make an energy drink by mixing 1 cup of the concentrate with 5 cups of water.

   a. What is the ratio of cups of concentrate to cups of water?
   b. If you use 2 cups of concentrate, how many cups of water will you need?
   c. How many cups of energy drink will this make?
   d. What is the percentage concentration of the drink?
   e. If you have 22 ½ cups of water, how many cups of concentrate will you need?

2. Convert the following temperatures to degrees Celsius:

   a. 58 ^{o}F
   b. 12 ^{o}F
   c. -5 ^{o}F
   d. 32 ^{o}F
   e. -40 ^{o}F

3. Convert the following temperatures to degrees Fahrenheit:

   a. 110 ^{o}C
   b. 25 ^{o}C
   c. 60 ^{o}C
   d. -7 ^{o}C
   e. 32 ^{o}C

Maps and Scale

1. A map has a scale of 1 : 150 000

a. If I measure 3cm on the map, what is this in reality in km?
b. If I measure 45mm on the map, what is this in reality in km?
c. If I am 18km away from the school, what will this distance be on the map in cm?
d. If two buildings are 3km apart, what will this distance be on the map in mm?

2. A distance of 6km is represented by 2cm on a map. What is the scale of the map?

3. A distance of 14km is represented by 8mm on a map. What is the scale of the map?

4. A distance of 10km is represented by 4cm on a map. What is the scale of the map?

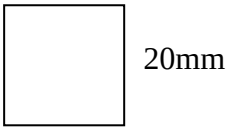
5. A distance of 3km is represented by 6mm on a map. What is the scale of the map?

Area and Perimeter 1

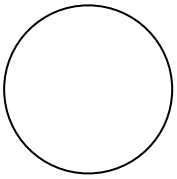
Find the area and perimeter of the shapes:

1.

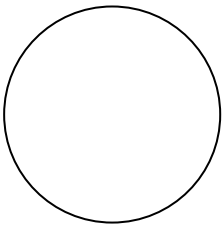
2.



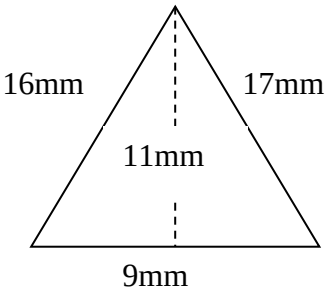
3.



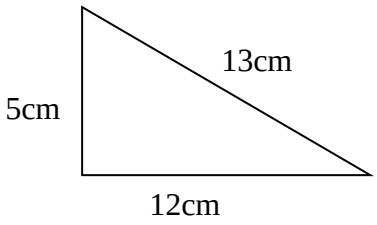
4.



5.

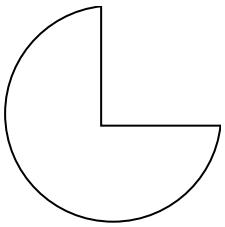


6.



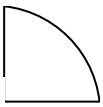
MATHS JOKE

7.



r = 70mm

8.

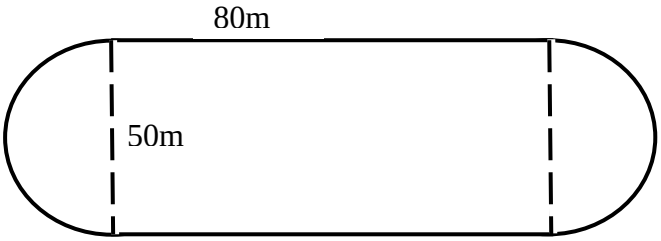


r = 22cm

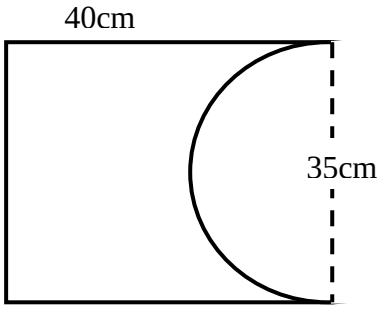
Area and Perimeter 2

Find the area and perimeter of the following shapes:

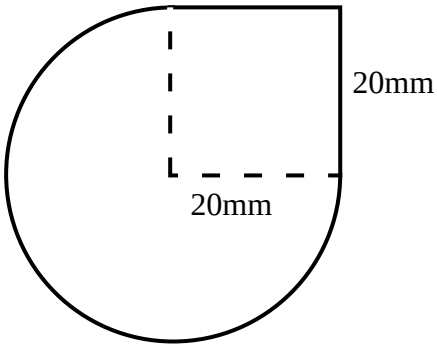
1.



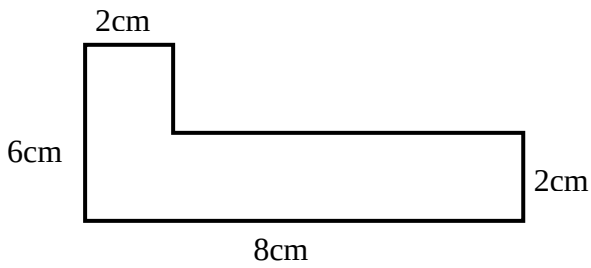
2.



3.



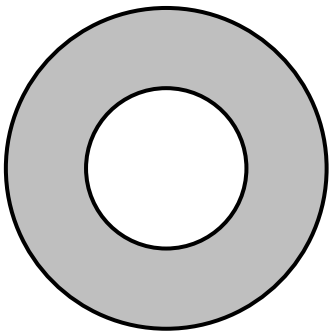
4.



Area and Perimeter 3

Find the area and perimeter of the following shapes:

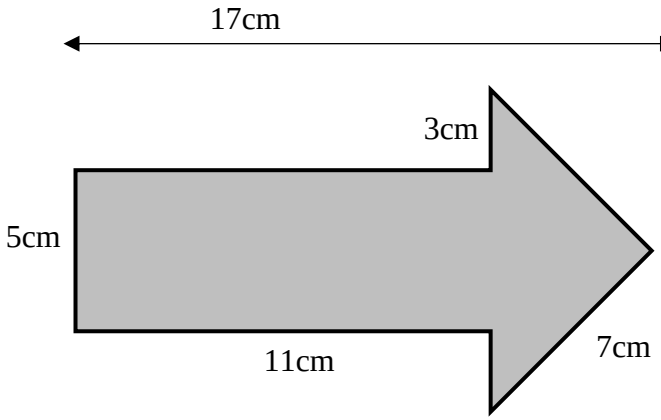
1.



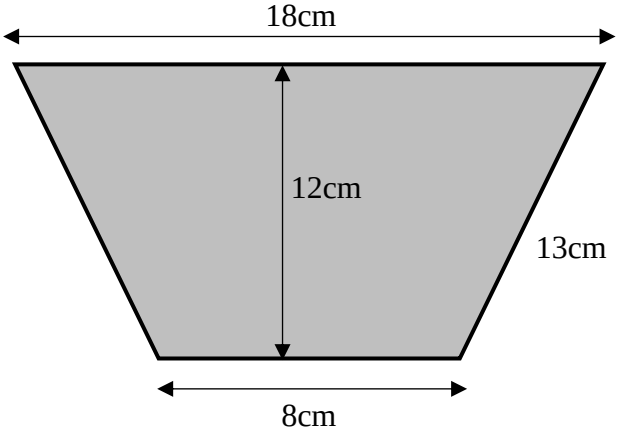
Diameter big circle: 14cm

Radius small circle: 3cm

2.



3.



Probability 1




1. I roll a die.

    a. What is the probability of rolling a 5?

    b. What is the probability of not rolling a 5?

    c. What is the probability of rolling a 1 or 2?

    d. What is the probability of rolling a 7?

    e. What is the probability of not rolling an even number?

2. I draw a card at random from a shuffled deck.

    a. What is the probability of drawing a Queen?

    b. What is the probability of drawing a number card?

    c. What is the probability of not drawing a face card (King, Queen, Jack)?

    d. What is the probability of drawing a Spade?

    e. What is the probability of not drawing a Heart?

3. I fill a bag with jelly beans. There are 12 red jelly beans, 18 blue, 6 green, and 4 orange. I take out a jelly bean at random.

   a. What is the probability of picking a red jelly bean?

   b. What is the probability of picking a blue or green jelly bean?

   c. What is the probability of not picking an orange jelly bean?

   d. What is the probability of not picking an orange or blue jelly bean?

   e. What is the probability of picking a red, blue or orange jelly bean?

Probability 2

1. I have a bag containing 2 red sweets, 5 green sweets, 3 orange sweets and a yellow sweet. How many sweets will I have to take out of the bag at random to be sure to have at least 2 of the same colour?

2. I have a deck of cards, without Jokers. How many cards will I need to draw at random to be sure I have at least one of each suit (Hearts, Diamonds, Clubs, Spades)?

3. I roll 2 dice. Draw up a table representing all the possible outcomes.

4. I roll a die and then flip a coin. Draw a tree diagram showing all possible outcomes.

Name: _____

1. I find Maths Literacy
    - Very difficult
    - Difficult
    - Average
    - Easy
    - Very easy

2. I understand the work in Maths Literacy class
    - Everyday
    - More than half the time
    - Less than half the time
    - Never

3. I need someone to re-explain Maths Literacy work to me in class
    - Everyday
    - More than half the time
    - Less than half the time
    - Never

4. Who explains the Maths Literacy work to you in class?

    _____

5. This person/these people help me with Maths Literacy classwork

    - Everyday
    - More than half the time
    - Less than half the time
    - Never

6. The Maths Literacy textbook is useful in explaining concepts

    - Everyday
    - More than half the time
    - Less than half the time
    - Never

7. I attempt my Maths Literacy homework

    - Everyday
    - More than half the time
    - Less than half the time
    - Never

8. I struggle with my Maths Literacy homework

    - Everyday
    - More than half the time
    - Less than half the time
    - Never

9. I need someone to re-explain Maths Literacy work to me at home

- Everyday
- More than half the time
- Less than half the time
- Never

10. Who explains Maths Literacy work to you at home?

_____

11. How well do they explain the Maths Literacy work?

- I understand fully
- I understand more than half the time
- I understand less than half the time
- I still don't understand

12. This person/these people help me with my Maths Literacy homework

- Everyday
- More than half the time
- Less than half the time
- Never

13. I complete my Maths Literacy homework

- Everyday
- More than half the time
- Less than half the time
- Never

14. Describe the space where you usually do your homework.

_____

_____

_____

15. Do you think this is a suitable space to be working in? Why/why not?

_____

_____

_____

16. Do you do your homework in the same place everyday? If not, why not?

_____

_____

_____

17. Can you stream videos on your cellphone?

- Yes
- No
- Not sure

18. Can you afford to stream videos on your cellphone?

- Yes
- No
- Not sure

19. Do you have your cellphone with you while you are doing your homework?

- Yes
- No
- Sometimes

20. Would you like to incorporate watching video tutorials on your cellphone into your homework?

- Yes
- No
- Not sure

21. How do you think your parents would feel about you using your cellphone for your homework?

_____

22. How old are you, in years and months?

Yrs

14
15
16
17

Months

1	2	3
4	5	6
7	8	9
10	11	

Appendix B2

1	I find Maths Literacy	very difficult	difficult	average	easy	very easy	
			1	5	3		
2	I understand the work in Maths Literacy class	Everyday	More than half the time	Less than half the time	Never	N/A	
		5	4				
3	I need someone to re-explain Maths Literacy work to me in class	everyday	more than half the time	less than half the time	never	N/A	
			2	7			
4	Who explains the Maths Litearcy work to you in class?	teacher	specific student	any student	student or teacher	N/A	
		5	2	1	1		
5	This person/these people help me with Maths Literacy classwork	everyday	more than half the time	less than half the time	never	N/A	
		3		5	1		
6	The Maths Literacy textbook is useful in explaining concepts	everyday	more than half the time	less than half the time	never	N/A*	*does not have a textbook
			2	5	1	1	
7	I attempt my Maths Literacy homework	everyday	more than half the time	less than half the time	never	N/A	
		5	2	2			
8	I struggle with my Maths Literacy homework	everyday	more than half the time	less than half the time	never	N/A	
				4	5		
9	I need someone to re-explain Maths Literacy work to me at home	everyday	more than half the time	less than half the time	never	N/A	
			1	1	7		
10	Who explains Maths Literacy work to you at home?	tutor	N/A				
		1	8				
11	How well do they explain the Maths Literacy work?	I understand fully	I understand more than half the time	I understand less than half the time	I still don't understand	N/A	
			1			8	
12	This person/these people help me with my Maths Literacy homework	everyday	more than half the time	less than half the time	never	N/A	
			1			8	
13	I complete my Maths Literacy homework	everyday	more than half the time	less than half the time	never	N/A	
		6	2	1			
14	Describe the space where you usually do your homework	desk*	room	school library/learning centre	dinner table	on bed	*one student noted "with music"
		5	1	1	1	1	
15	Do you think this is a suitable space to be working in? Why/why not?	desk	room	school library/learning centre	dinner table	bed	
		yes, quiet, no distractions	yes, quiet environment	yes, quiet, help available	yes, quiet	yes, more comfortable	
		yes, calm					
		yes, easy to work					
16	Do you do your homework in the same place everyday? If not, why not?	yes	no*				*does homework where it is *"depends on the mood I'm in"
		7	2				
17	Can you stream videos on your cellphone?	yes	no	not sure			
		8		1			
18	Can you afford to stream videos on your cellphone?	yes	no	not sure			
		8		1			
19	Do you have your cellphone with you while you are doing your homework?	yes	no	sometimes			
		1	1	7			
20	Would you like to incorporate watching video tutorials on your cellphone into your homework?	yes*	no	not sure			*rather on iPad
		4		5			

Appendix B2

21	How do you think your parents would feel about you using your cellphone for your homework?	ok if educational	would not mind	would be happy			
		1	7	1			
22	How old are you, in years and months?	yrs	months				*two students did not answer question
		15	4				
		15	7				
		16	1				
		16	1				
		16	4				
		16	11				
		18	2				

Appendix C

Focus Group Questions:

1. How well do you understand the work in class?
2. Who helps you the most in class, in regards to understanding the work?
3. What do you do if you don't understand the work in class?
4. How well are you able to do the homework?
5. What do you think the difference is between class work and homework?
6. Is there any other question you wish I'd asked you?

Appendix D

Name: _____

Video	Did I watch?	How helpful?	Comments?
1		1 2 3 4 5	
2		1 2 3 4 5	
3		1 2 3 4 5	
4		1 2 3 4 5	
5		1 2 3 4 5	
6		1 2 3 4 5	
7		1 2 3 4 5	
8		1 2 3 4 5	
9		1 2 3 4 5	
10		1 2 3 4 5	
11		1 2 3 4 5	
12		1 2 3 4 5	
13		1 2 3 4 5	
14		1 2 3 4 5	
15		1 2 3 4 5	
16		1 2 3 4 5	
17		1 2 3 4 5	
18		1 2 3 4 5	
19		1 2 3 4 5	
20		1 2 3 4 5	
21		1 2 3 4 5	
22		1 2 3 4 5	

Name: _____

Video	Attempted?	Correct?	Comments/Notes
1	1 2 3 4 5	1 2 3 4 5	
2	1 2 3 4 5	1 2 3 4 5	
3	1 2 3 4 5	1 2 3 4 5	
4	1 2 3 4 5	1 2 3 4 5	
5	1 2 3 4 5	1 2 3 4 5	
6	1 2 3 4 5	1 2 3 4 5	
7	1 2 3 4 5	1 2 3 4 5	
8	1 2 3 4 5	1 2 3 4 5	
9	1 2 3 4 5	1 2 3 4 5	
10	1 2 3 4 5	1 2 3 4 5	
11	1 2 3 4 5	1 2 3 4 5	
12	1 2 3 4 5	1 2 3 4 5	
13	1 2 3 4 5	1 2 3 4 5	
14	1 2 3 4 5	1 2 3 4 5	
15	1 2 3 4 5	1 2 3 4 5	
16	1 2 3 4 5	1 2 3 4 5	
17	1 2 3 4 5	1 2 3 4 5	
18	1 2 3 4 5	1 2 3 4 5	
19	1 2 3 4 5	1 2 3 4 5	
20	1 2 3 4 5	1 2 3 4 5	
21	1 2 3 4 5	1 2 3 4 5	
22	1 2 3 4 5	1 2 3 4 5	

Interview Questions:

1. Did you watch the videos?
2. Do you usually struggle with the homework?
3. Why did you watch the videos?
4. **Did you find the videos helpful/valuable?
5. What did you find most valuable about the videos?
6. Would you continue to watch the videos?
7. How many videos did you watch?
8. **Why did you stop watching the videos?
9. Why didn't you watch the videos?
10. What did you do if you got stuck?
11. **Would you have watched if you had needed the help?
12. **Is there anything that would have made you watch the videos?
13. Did your friends watch the videos?
14. Would you consider watching the videos to be cheating?
15. How did your parents/guardians feel about the videos?
16. Is your phone usually near you when you do your homework?
17. Would you have been embarrassed if other students knew you had watched the videos?
18. Why do you think your friends did/didn't watch the videos?
19. Do you think it was a lot of time and effort to watch the videos?
20. Can you suggest any improvements for the videos or the whole process?

Key:

Green – questions for students who watched videos
Red – questions for students who did not watch videos

Added:

Question 4
Question 11
Question 12

Deleted:

Question 8

INTERVIEWER: First question, I want you to tell me, how well do you understand the work in class? Generally.

MEGAN: Extremely well.

INTERVIEWER: Now I want you to be honest.

MEGAN: I always understand. Sometimes I don't.

GREG: It's OK.

HAYLEY: I understand it most of the time.

MEGAN: I always leave the lesson knowing the work.

INTERVIEWER: Kyle, Fred, anything you want to add?

KYLE: I understand it pretty well.

INTERVIEWER: Fred, you too?

FRED: *noise of agreement*

INTERVIEWER: And then, who helps you the most in class? Is it me who comes around to help you? Is it the person next to you?

MEGAN: You.

FRED: You.

HAYLEY: You.

INTERVIEWER: Anyone asks the person next to them for help? Or someone else for help?

MEGAN: Uh, I sometimes ask, um...

GREG: You ask me sometimes, but that's for the answers.

MEGAN: Sometimes I do. Every now and then I ask Greg, cos he's always right.

Indistinct

INTERVIEWER: What about if you don't understand the work in class. What do you do?

HAYLEY: Ask the person...

GREG: Ask you.

KYLE: Ask you.

MEGAN: Ask the person in front of us, ask you, ask someone.

INTERVIEWER: So ask someone. Is it usually me? Or would you ask anyone?

MEGAN: Usually you.

noises of agreement

INTERVIEWER: How well are you able to do your homework usually?

HAYLEY: Not well.

MEGAN: Well I usually finish my homework in class when you give us that like five minute time to do it.

INTERVIEWER: And you find that fine?

MEGAN: Ya.

KYLE: I don't have a chance to do Maths Lit.

INTERVIEWER: You don't have a chance to do Maths Lit at home?

KYLE: Cos I've been catching up.

INTERVIEWER: OK, cos you're catching up the work still. Fred?

FRED: I usually finish it in class.

INTERVIEWER: You don't struggle with it? You find it fine?

FRED: Most of the time, ya.

GREG: Same.

INTERVIEWER: And Hayley?

HAYLEY: Um ya, I'm still catching up, so I don't know.

INTERVIEWER: You shouldn't still be catching up.

HAYLEY: Ya, I know.

INTERVIEWER: What do you think is the difference between classwork and homework?

MEGAN: Um, classwork is more engageable whereas homework is like um...

FRED: Homework is more from memory.

INTERVIEWER: So is that how you feel, that you need to remember the work to be able to do it for homework?

FRED: Ya.

MEGAN: Ya.

INTERVIEWER: And do you find you usually are able to remember the work?

MEGAN: Ya.

noises of agreement

INTERVIEWER: No one struggles remembering the work? No one gets home and suddenly, I don't remember how to do this?

MEGAN: Sometimes.

GREG: Sometimes.

Indistinct

INTERVIEWER: Finally, can you think of any questions I've missed here, that you think I should have asked you?

MEGAN: Did you ask if we enjoy Maths Lit?

INTERVIEWER: I didn't, but that's not really the point at the moment, unfortunately.

MEGAN: I think you should have asked that.

INTERVIEWER: Do you enjoy Maths Lit?

MEGAN: It's OK.

INTERVIEWER: Any other comments?

no other comments

INTERVIEWER: OK.

****

INTERVIEWER: First question, how well do you understand the work in class?

BRIAN: Pretty well.

SARAH: The work load?

INTERVIEWER: The actual work.

BRIAN: Pretty well.

PHILLIP: Ya.

SARAH: It's pretty manageable.

PHILLIP: Just some concepts.

INTERVIEWER: So some concepts you struggle with?

PHILLIP: Ya.

INTERVIEWER: And then who helps you the most in class? With understanding the work?

PHILLIP: Brian.

SARAH: Mandy.

BRIAN: We all help each other.

INTERVIEWER: And what do you do if you don't understand the work in class?

BRIAN: Ask you or ask Mandy, or...

INTERVIEWER: So ask me or ask the people next to you?

BRIAN: Ya.

INTERVIEWER: How well are you able to do your homework usually?

BRIAN: Pretty well.

PHILLIP: Pretty well.

MANDY: Ya.

Indistinct

BRIAN: I usually finish it here. It just makes it easier.

INTERVIEWER: What do you think is the difference between classwork and homework?

BRIAN: Well homework is going over what we did -

PHILLIP: In class.

BRIAN: In classwork you're learning something new.

SARAH: There's an interaction between everybody in class.

INTERVIEWER: So homework is on your own? Reinforcing what you did in class?

noises of agreement

INTERVIEWER: Last question, can you think of anything else I haven't asked you, that's maybe related to this that you think I should have asked?

BRIAN: In the survey or now?

INTERVIEWER: Right now, or in the survey as well. Any question that you think I've left out.

BRIAN: Not really.

Indistinct

INTERVIEWER: Great, thanks guys.

INTERVIEWER: Firstly, did you watch any of the videos?

KYLE: No.

FRED: Yes.

MEGAN: I did.

INTERVIEWER: So Megan did. I'm going to start with Megan. OK, you watched the videos -

MEGAN: Ya.

INTERVIEWER: And do you usually struggle with the homework?

MEGAN: No, not necessarily.

INTERVIEWER: OK, so why did you watch the videos?

MEGAN: Well, there would be a certain equation or a certain section that I'd be struggling with, and then I'd just watch it to egg me on.

INTERVIEWER: OK, so what did you find most valuable about watching the videos?

MEGAN: Well that it... there was only one way of doing it... and it gave it to us like that.

INTERVIEWER: Do you think it was a lot of time and effort to watch the videos?

MEGAN: Not really. You just scan the thing and then you watch the video. And they weren't that long.

INTERVIEWER: Would you see it as cheating at all if you watch the videos?

MEGAN: No, it's not like it's a test. I think that it's fair, cos it's there for everyone, just if you want to use it.

INTERVIEWER: And would it be embarrassing for you if other students knew you watched the videos?

MEGAN: No. I mean, it's there to help us. I don't care what FRED or KYLE or anyone else in the class thinks!

INTERVIEWER: Is your phone usually near you while you do your homework?

MEGAN: Not really, but sometimes I need a calculator, or Google Translate for Afrikaans, you know? And for the videos, but I usually used my Ipad for that.

INTERVIEWER: How did your parents or whoever's at home feel about the videos?

MEGAN: Um, I think they think it was a good idea. They didn’t watch any or anything though.

INTERVIEWER: Do you know if any of your friends watched the videos?

MEGAN: I don’t think HAYLEY did. FRED said he did, but I think he was copying me.

INTERVIEWER: And can you think of any improvements for the videos? Or for the whole process?

MEGAN: Um, let me think. Maybe, make it a little more smoother, maybe put some animation in.

INTERVIEWER: And would you continue to watch the videos?

MEGAN: Ya.

INTERVIEWER: And how many videos did you watch? Do you remember?

MEGAN: I watched all of them.

INTERVIEWER: OK great. So those are my questions for Megan, and for you two, why didn't you watch the videos?

FRED: I did.

KYLE: I was too lazy to download the app.

INTERVIEWER: You didn't download the app?

KYLE: No.

INTERVIEWER: OK, Fred, you said you did or you didn't?

FRED: I did.

INTERVIEWER: You did? OK, then same questions that I asked Megan. Why did you watch them?

FRED: Um, because I was stuck on a question.

INTERVIEWER: And did you find them valuable?

FRED: Ya.

INTERVIEWER: OK what specifically helped you?

FRED: Um, they explained it very well. They used easy examples.

INTERVIEWER: Do you think it was a lot of time and effort to watch the videos?

FRED: No.

INTERVIEWER: And would you see it as cheating if you watched the videos?

FRED: It's not cheating cos it's just homework.

INTERVIEWER: Would it be embarrassing for you if other people or students knew you watched the videos?

FRED: No…

INTERVIEWER: And do you usually struggle with the homework?

FRED: Sometimes.

INTERVIEWER: Is your phone usually near you when you're doing your homework?

FRED: Um, sometimes.

INTERVIEWER: How did your parents or whoever's at home, how did they feel about the videos?

FRED: They didn't really notice.

INTERVIEWER: Do you know if any of your friends watched the videos?

FRED: Um, I'm not sure.

INTERVIEWER: And can you think of any improvements for them?

FRED: No.

INTERVIEWER: And would you continue to watch them if they carried on?

FRED: Yes.

INTERVIEWER: And do you know how many you watched roughly?

FRED: All of them.

INTERVIEWER: OK, thanks, Fred. So Kyle, you said you didn't download the app.

KYLE: No.

INTERVIEWER: Why not?

KYLE: I was too lazy.

INTERVIEWER: Do you think it was a lot of time and effort to watch the videos?

KYLE: I don’t know, I’m just lazy.

INTERVIEWER: Do you struggle with the homework though?

KYLE: I didn't really do it.

INTERVIEWER: You didn't really do the homework...

KYLE: I mean I did a little bit of it, but like... the ones I did it was easy for me.

INTERVIEWER: And if you got stuck on a question, what did you do?

KYLE: I left it out.

INTERVIEWER: Do you know if your friends watched the videos?

KYLE: Ya.

INTERVIEWER: They did?

KYLE: Ya.

INTERVIEWER: But that didn't make you want to watch them?

KYLE: No.

INTERVIEWER: Would you have seen it as cheating at all if you had watched the videos?

KYLE: No.

INTERVIEWER: And would you have been embarrassed if other students knew that you had watched the videos?

KYLE: No, I just didn’t want to.

INTERVIEWER: OK, is your phone usually near you when you do your homework?

KYLE: It’s on silent in my pocket.

INTERVIEWER: And how did your parents or whoever’s at home feel about the whole idea?

KYLE: They didn’t know about it.

INTERVIEWER: Are there any improvements you can think of for the videos, even though you didn't watch any, but for the whole process that would make it more likely for you to watch them?

KYLE: Um, it be on YouTube.

INTERVIEWER: It was on YouTube.

KYLE: Oh.

INTERVIEWER: Anything else?

KYLE: No.

INTERVIEWER: OK, thanks.

****

INTERVIEWER: Did either of you watch any of the videos?

SARAH: No.

GREG: No.

INTERVIEWER: So tell me why you didn't.

SARAH: Never got stuck.

GREG: *Noise of agreement*

INTERVIEWER: So you didn't need any help with the homework?

SARAH: No, not really.

GREG: Me neither.

INTERVIEWER: If you had got stuck, would you have watched the videos?

GREG: Ya.

SARAH: Of course.

INTERVIEWER: Do you think it was a lot of time and effort to watch the videos?

SARAH: No, it seemed very easy, cos you just scan it on your phone, don’t you?

GREG: Ya, it seemed easy.

INTERVIEWER: Is your phone usually near you when you do your homework?

SARAH: I try to keep my phone away for an hour or so, but I also like to check it every now and then. Kind of like a reward for working.

GREG: I don’t really have my phone near me.

INTERVIEWER: How did your parents or whoever’s at home, how did they feel about the videos with the homework.

GREG: They didn’t really know.

SARAH: Ya, they didn’t really know about it.

INTERVIEWER: And do you know if your friends watched the videos?

SARAH: Um, we don’t really talk about it. I didn’t even know if GREG had.

GREG: Ya, I don’t know about anyone else.

INTERVIEWER: Can you think of any improvements, even though you didn't watch them, but any improvements to the whole process that would have made you want to watch them even if you weren't stuck on your homework?

SARAH: Maybe if we didn't have to download them off the Internet or watch them on the Internet. Maybe if we could have them on a flash drive or something like that.

INTERVIEWER: So that you wouldn't have to use data to use them?

SARAH: I mean I have the facility, just...

INTERVIEWER: It would have been easier to have them there with you?

SARAH: Ya.

INTERVIEWER: Greg?

GREG: Also, if you gave it to us... if you showed it to us... in class. If you showed it to us and how to use it...

INTERVIEWER: Well we did do one in class, together, the first day. I don't know if you were here that day.

GREG: I don't know.

INTERVIEWER: So you mean if the process had been explained a bit better so that you knew what to do?

GREG: Ya, and also, um, a lot of these... like you think of something like this to be very cheesy, and then, like... I'm not saying that yours are cheesy... but usually people won't go into it because it's such, like... they don't feel like doing it or like Kyle, they're too lazy... but maybe if you showed it to us... and I'm sure yours was very nice, so if you showed it to us in class and we actually saw that... it wasn't as cheesy as some of them, then we would have made an effort...

INTERVIEWER: So maybe if you knew exactly what it was?

GREG: Ya.

INTERVIEWER: And would you have been embarrassed if other students knew that you had watched the videos?

SARAH: No.

GREG: It’s not embarrassing, it’s just watching videos to help with stuff.

INTERVIEWER: And do you think if you had watched the videos, would you have seen that as "cheating"?

SARAH: No.

GREG: I'm sure if we'd struggled it would... It's not like we're cheating cos it's not a test or anything like that, we're just looking for help.

INTERVIEWER: So you didn't need the help, so you didn't feel the need to look at the videos?

GREG: Ya.

SARAH: Also, the final answer wasn't in the videos if I'm correct.

INTERVIEWER: No, well that was the point. It didn't give you the answer, it told you how to find it.

SARAH: Exactly. So it shows you how to catch the fish, it doesn't give you the fish.

GREG: But I would be interested in using them if I did struggle in the future.

INTERVIEWER: So if you'd needed the help you would have used them?

GREG: Ya.

INTERVIEWER: OK, thanks guys.

****

INTERVIEWER: Firstly, did you watch the videos?

BRIAN: Like one.

INTERVIEWER: And was it helpful?

BRIAN: Ya, it explained the stuff well.

INTERVIEWER: So why didn’t you watch most of them? What’s

your reason?

BRIAN: Cos I didn't need to.

INTERVIEWER: Do you usually struggle with the homework?

BRIAN: Not really.

INTERVIEWER: Would you have seen it as cheating if people knew you watched the videos?

BRIAN: No, I think they just help.

INTERVIEWER: And would have been embarrassed at all if other students knew you watched them?

BRIAN: No, not at all.

INTERVIEWER: So, if you did need help with the homework you would have watched them?

BRIAN: Ya.

INTERVIEWER: Do you know if your friends watched the videos?

BRIAN: I think PHILLIP watched most of them.

INTERVIEWER: Do you feel it was a lot of time and effort to watch the videos?

BRIAN: No, it was easy, cos you just had to scan them.

INTERVIEWER: So basically you didn't watch because you felt that you didn't need help with the homework?

BRIAN: Ya, I only watched when I needed to.

INTERVIEWER: Is your phone usually near you when you do your homework?

BRIAN: Not really.

INTERVIEWER: How did your parents, or whoever's around at home, how did they feel about the whole idea?

BRIAN: I don't think they really knew, cos I would do my homework at school.

INTERVIEWER: OK, so they didn't really have any part in it.

BRIAN: No.

INTERVIEWER: So I know you didn't watch most of them, but can you think of any

kind of improvements or suggestions to maybe make them a bit more enticing or to make you want to watch them?

BRIAN: Um, I don't know. They were pretty good. They were fine.

INTERVIEWER: So basically you didn't need the help so you didn't watch the videos?

BRIAN: Ya.

INTERVIEWER: And did you complete most of the homework. You completed most of the questions of the homework?

BRIAN: Ya

****

INTERVIEWER: Firstly, did you watch any of the videos?

PHILLIP: I did.

INTERVIEWER: OK, how many roughly did you watch?

PHILLIP: Not many. Like the things I didn't understand obviously I watched.

INTERVIEWER: So that was your reason for watching the videos?

PHILLIP: Yes, if I didn't understand a concept or something.

INTERVIEWER: And do you usually struggle with the homework?

PHILLIP: Well honestly, um, no…

INTERVIEWER: Not really?

PHILLIP: Only with some sections.

INTERVIEWER: And those are the sections where you watched the videos?

PHILLIP: Ya.

INTERVIEWER: What do you think was the most valuable thing about the videos?

PHILLIP: It was visual.

INTERVIEWER: So you could see what was going on?

PHILLIP: Ya.

INTERVIEWER: And can you think of any improvements or suggestions to make

them better or to make you want to watch them?

PHILLIP: Um, no I enjoyed them, I think cos they just explained it and got to the point and that's what I liked about it.

INTERVIEWER: And would you continue to watch them if they continued?

PHILLIP: Ya, they helped me.

INTERVIEWER: And with your cellphone, is your phone usually on or around when you do your homework?

PHILLIP: *nervous laughter* Ya… is that bad?

INTERVIEWER: No, I mean in this case it would be good, cos then you've got it to help you with the questions. Do you know if any of your friends watched the videos?

PHILLIP: I know BRIAN watched, I think, and MANDY.

INTERVIEWER: And how did your parents or whoever's at home feel about the videos?

PHILLIP: Um, they didn't really know.

INTERVIEWER: And you don't see it as cheating at all if you watch the videos? To help you with your homework.

PHILLIP: No. *laughter* It helps you understand.

INTERVIEWER: Would you be embarrassed if other students knew you had watched the videos?

PHILLIP: No. *laughter* No one cares if you watch them.

INTERVIEWER: Do you think it was a lot of effort to watch the videos? A lot of time?

PHILLIP: No! It was quite short, the videos.

INTERVIEWER: So your main reason for not watching is you didn't need the help with the homework?

PHILLIP: Ya.

INTERVIEWER: And you watched them when you needed the help?

PHILLIP: Ya.

INTERVIEWER: And do you find that they actually helped you with the homework?

PHILLIP: Ya, cos I could finish the homework.

INTERVIEWER: OK cool, that's everything I think.

****

INTERVIEWER: Did you watch any of the videos?

MANDY: No.

INTERVIEWER: And why didn't you watch the videos?

MANDY: Most of the time I didn't have time to watch it, and I wanted to try without watching the videos. Try to do it myself.

INTERVIEWER: So would you see it as cheating in a way, to watch the videos?

MANDY: No.

INTERVIEWER: You just wanted to try on your own?

MANDY: Ya.

INTERVIEWER: Do you usually struggle with the homework?

MANDY: No, it's usually easy.

INTERVIEWER: So you said you didn't have time a lot of the time. Do you think it was a lot of time and effort to watch the videos?

MANDY: No, I don't think so. I was just a bit lazy, most of the time.

INTERVIEWER: OK, and do you know if your friends watched the videos?

MANDY: Ya, they did.

INTERVIEWER: Would you find it embarrassing at all if other people or other students knew you watched the videos?

MANDY: No.

INTERVIEWER: So if you did need the help, what would you do?

MANDY: I would have watched the videos or asked you to help.

INTERVIEWER: How did your parents or anyone who was around at home feel about the videos, if they knew about it?

MANDY: They thought that if I need the help I should go get the help.

INTERVIEWER: Is your phone usually near you when you do your homework?

MANDY: Ya, but I don't use it all the time.

INTERVIEWER: So obviously you didn't use the videos, but can you think of any sort of improvements or suggestions that might have made you want to use them?

MANDY: I can't think of anything right now, at the moment.

INTERVIEWER: Is there nothing that would have made you use the videos?

MANDY: No…

INTERVIEWER: OK, thanks.

****

INTERVIEWER: Did you watch any of the videos?

HAYLEY: Um, I think in class.

INTERVIEWER: In class?

HAYLEY: I think I watched one in class. Did we not all watch…

INTERVIEWER: We watched the very first one together.

HAYLEY: Ya, that's the only one I watched.

INTERVIEWER: OK, did you download the app?

HAYLEY: No.

INTERVIEWER: What was your reason for not watching the videos?

HAYLEY: Um, I think the main reason was just because… I was… honestly I think I was just busy, didn't really have time to do it.

INTERVIEWER: So do you think it would have been a lot of time and effort to watch the videos?

HAYLEY: Ya, I think so, ya.

INTERVIEWER: Do you know what the whole thing entailed? Do you know how it worked?

HAYLEY: Was it, help on like, how to do the homework, like tutoring?

INTERVIEWER: Ya, it was a video tutorial that told you how to answer the question.

HAYLEY: Yeah.

INTERVIEWER: So you think it would have been too much effort to watch it?

HAYLEY: Ya, I just thought no… basically, I don't know… I didn't really think about it that much. I think I basically more just forgot than actually did it. I just think ya, I genuinely forgot.

INTERVIEWER: And would you have seen it as cheating if you had watched the videos?

HAYLEY: No.

INTERVIEWER: And would you have found it embarrassing if other students knew you had watched the videos?

HAYLEY: No.

INTERVIEWER: Do you know if your friends watched the videos?

HAYLEY: Not that I know of.

INTERVIEWER: OK.

HAYLEY: But they could have. I don't know.

INTERVIEWER: So you don't know if they watched?

HAYLEY: No.

INTERVIEWER: When you do your homework is your phone usually near you?

HAYLEY: *long pause* Ya. Usually quite close to me. For time. Mainly just so I can look at the time, cos otherwise I just get distracted.

INTERVIEWER: Did your parents or anyone at home know about the videos? How did they feel about them?

HAYLEY: They didn't really know about it.

INTERVIEWER: Do you struggle with the homework?

HAYLEY: Um, sometimes… I don't always know what to do… with some questions, ya, it can be kinda difficult.

INTERVIEWER: What did you do if you weren't able to do the homework?

HAYLEY: The homework… the school homework, or the homework on the thing?

INTERVIEWER: The school homework. The homework that I gave you, for homework.

HAYLEY: I would just not… I would try it and then I would come back to class and see what the answers were, so I could learn, if you know what I mean. Cos we would usually go over the work, and I would just write it down…

INTERVIEWER: And that was fine? It helped you enough?

HAYLEY: Ya, it worked well.

INTERVIEWER: And then lastly, you didn't really watch any of the videos, but can you think of any improvements or suggestions that might have made you want to watch them?

HAYLEY: Um… I think… I think right in the beginning I actually wanted to watch them, but as I said before I just forgot, so, honestly I think the way you did it in the beginning is fine, you know, it wasn't bad or anything, it worked well so…

INTERVIEWER: So it's more that you just forgot about it?

HAYLEY: Ya, it's more that I forgot about it.

INTERVIEWER: And if you remembered about it, do you think you would have used them?

HAYLEY: Yeah, probably. If I had remembered, ya.

INTERVIEWER: OK, thanks.

Fri 17 April

- very short lesson - loadshedding
  - no bell @ end of break
- 3/4 students hadn't done homework
- got through everything in lesson so hopefully no problems with homework
- student teacher lesson on Mon (??)

27 The Drive
Camps Bay
8005
Cape Town

Department of Education
Private Bag 9114
Cape Town
8000

24 February 2015

REQUEST FOR CONSENT FOR MASTERS DISSERTATION RESEARCH

Dear Minister,

My name is Emma Engers and I teach Mathematics and Mathematical Literacy at Herzlia High School in Cape Town.

I am currently completing a Masters degree at the University of Cape Town, studying the use of ICTs (Information and Communication Technologies) in Education through the School of Education.

For my Masters dissertation I propose to undertake a study in which I will be investigating the influence of video tutorials on High School students' understanding of Mathematical Literacy. This research will be undertaken under the supervision of Associate Professor Cheryl Hodgkinson-Williams from the Centre for Innovation in Learning and Teaching (CILT), and Dr Sheena Rughubar-Reddy from the Numeracy Centre.

I am hereby seeking your consent to have some of my own students at Herzlia High School participate in my research study.

The study will require me to monitor the students over a period of time, while giving them the option of using video tutorials which I will prepare and make available to them to assist them with their Mathematical Literacy homework. I will also be holding focus groups with as well as interviewing the students to ascertain to what extent the videos helped or hindered them. They will also be required to fill out a questionnaire.

I will take care to maintain absolute confidentiality when dealing with the students and the information they provide. The students will have the option to not participate in the study as well as to opt out at any point if they so wish.

If you require any further information, please do not hesitate to contact me on 073 174 8111, or emmacarlaengers@gmail.com, or to contact my supervisors on cheryl.hodgkinson-williams@uct.ac.za or sheena.rughubar-reddy@uct.ac.za.

Thank you for considering my request.

Yours sincerely,

Signed by candidate

Emma Engers

Appendix K

בס"ד

UNITED HERZLIA SCHOOLS
בתיה"ס המאוחדים הרצליה

23 February 2015
4 Adar 5775

Dear Students

As some of you may already know, I am currently busy with my Masters at the University of Cape Town. For my dissertation I plan to undertake a study involving the use of video tutorials.

I would like to use your class as the participants for this study. This will involve you being given video tutorials to help you with your homework. The video tutorials that I will prepare will be accessible via Quick Response (QR) codes (barcodes) which you can scan on your cellphones. You will not be forced to watch the video tutorials, but they will be available should you get stuck on a question in your homework. I would also like to interview all the participants on their experiences of using these video tutorials.

All information that you provide will be dealt with confidentially, and will not impact on your marks in any way. You will not be given extra homework to do for the study - the video tutorials will be there to help with your usual homework.

It is entirely up to you and your parents/guardians whether or not you would like to participate. You will not be punished or treated differently if you decide not to participate. If you would like to participate it is necessary that you have a cellphone with a barcode scanner, as well as the ability to stream videos on your cellphone. Alternatively, an iPad or tablet could be used instead. If you would like to participate but do not have the necessary requirements, please come speak to me and I will make an alternative arrangement.

If you would like to participate, please complete the form below and return it to me by the 26th of February. You will have the option of using video tutorials to assist you with your homework, and you will be required to attend one interview (either in a group or one on one) and complete a short survey.

Yours sincerely,

Signed by candidate

Ms Engers
Mathematical Literacy

I, _____, agree to take part in the study. I understand what this study entails and what will be expected of me. It is entirely my choice to take part in this study, and I have not been forced to participate in any way.

Signature: _____ Date: _____

M H Goldschmidt Avenue, Highlands Estate, Cape Town 8001. PO Box 3508, Cape Town 8000.
Tel +27 21 464 3300 Fax +27 21 461 2367 Email admin@herzlia.com
www.herzlia.com
PBO No. 18/11/13/2292 NPO No. 019-713-NPO Beneficiary of UNITED JEWISH CAMPAIGN (W. Cape)

Appendix L

בס"ד

UNITED HERZLIA SCHOOLS
בתיה"ס המאוחדים הרצליה

23 February 2015
4 Adar 5775

Dear Parents/Guardians

I teach your child Mathematical Literacy and am also currently completing my Masters in ICTs (Information and Communication Technologies) in Education at the University of Cape Town. For my dissertation I will be undertaking a study investigating the influence of video tutorials on High School students' understanding of Mathematical Literacy.

I would like to use my Grade 10 class as the participants for this study, and am hereby requesting your permission to allow your child to participate. The study will involve the students being given homework as per usual, but with the addition of video tutorials which I will prepare and provide through the use of Quick Response (QR) codes (barcodes) which they can scan on their cellphones. They will not be obliged to use these tutorials, but they will be there as an aid to assist with the homework should the students get stuck. They will not be given any extra homework for the study.

I will be monitoring the students' use of the video tutorials, as well as interviewing them on their experiences with the technology and having them fill out a short questionnaire. All information will be dealt with the utmost confidentiality, and will not impact in any way on your child's marks. There will be no repercussions if you decide not to allow your child to participate and they will not be punished or treated differently.

The costs of accessing these video tutorials will be roughly those of watching a video online on a cellphone. I cannot give an exact amount, but I would imagine each video would be in the region of one to two Rands. There would be no cost, of course, if the phone is connected to a wireless network. If your child does not have a cellphone capable of streaming videos but would still like to participate in the study, a tablet or iPad could be used instead. Otherwise he or she can speak to me and an alternative arrangement can be made.

I thank you in advance for considering to allow your child to be involved in this study. If you do give your permission, please complete the form below and return it to school by no later than the 26th of February.

Yours sincerely,

Signed by candidate

Emma Engers
Mathematical Literacy

I, _____, parent/guardian of _____, give permission for my child to participate in the abovementioned study. I understand what the study entails and what will be expected of my child.

Signature: _____ Date: _____

M H Goldschmidt Avenue, Highlands Estate, Cape Town 8001. PO Box 3508, Cape Town 8000.
Tel +27 21 464 3300 Fax +27 21 461 2367 Email admin@herzlia.com
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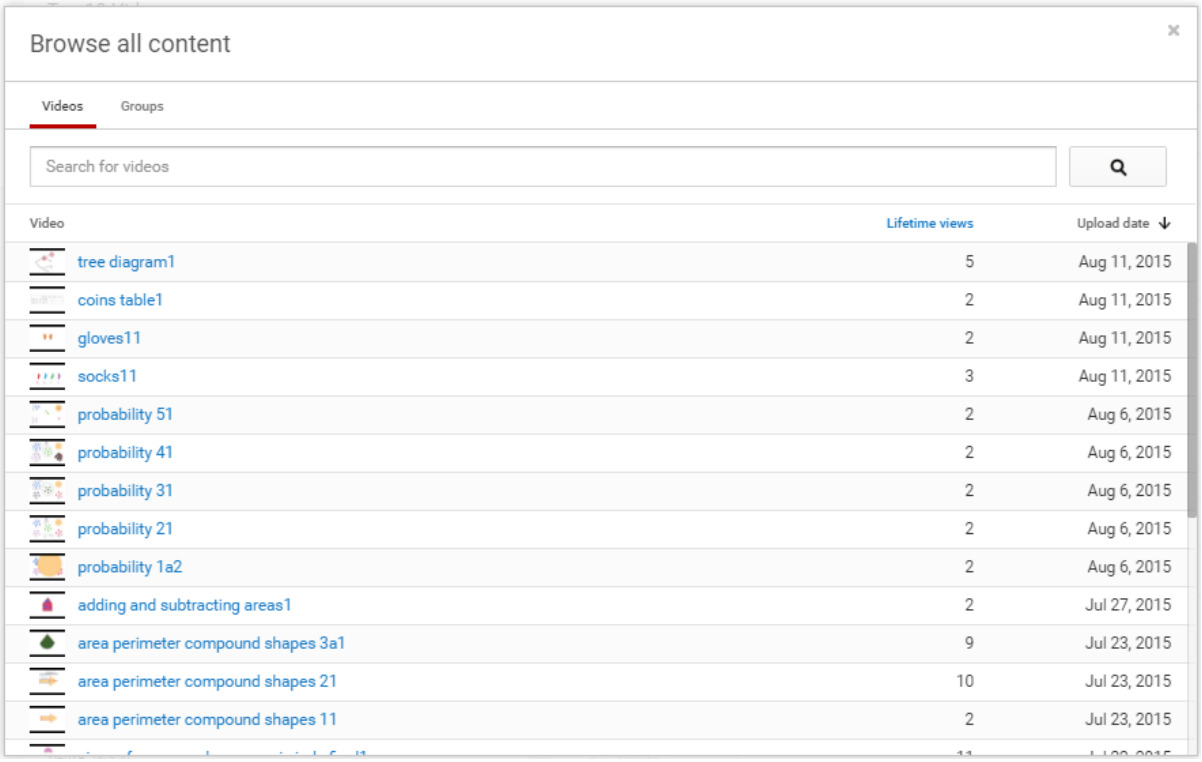

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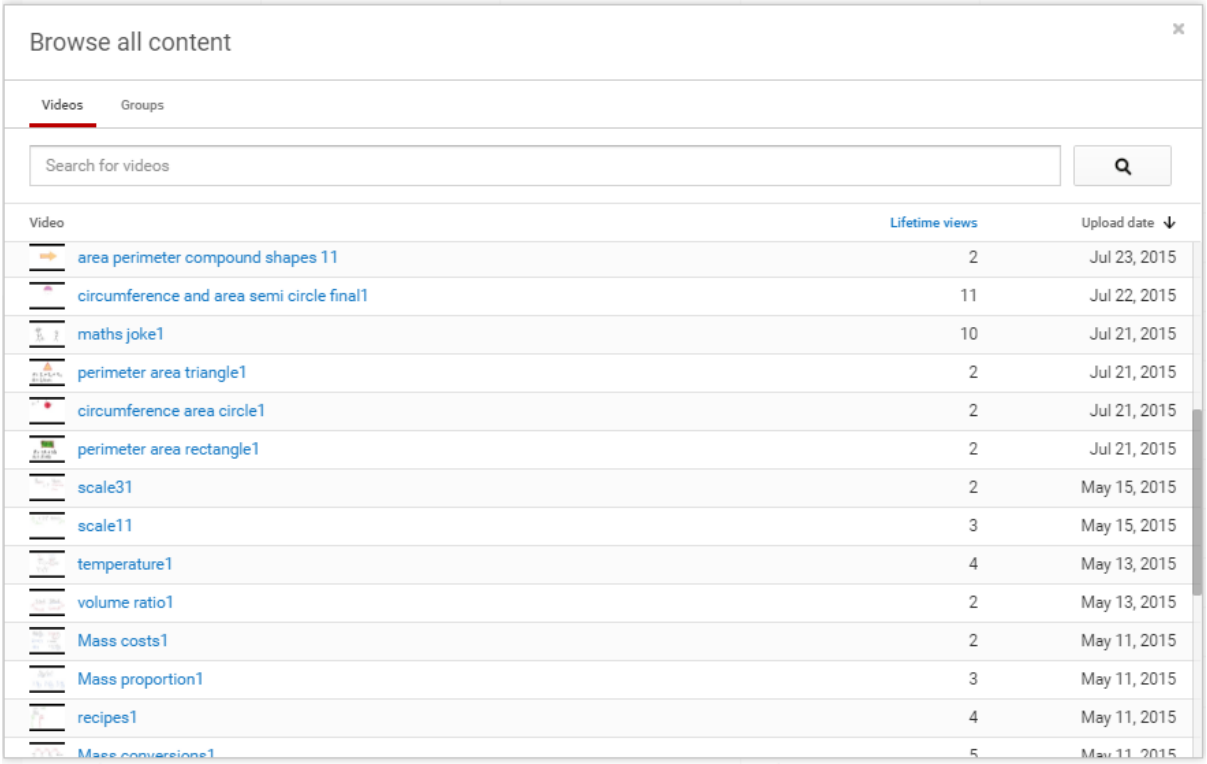
Videos | Groups

Search for videos

Video	Lifetime views	Upload date
tree diagram1	5	Aug 11, 2015
coins table1	2	Aug 11, 2015
gloves11	2	Aug 11, 2015
socks11	3	Aug 11, 2015
probability 51	2	Aug 6, 2015
probability 41	2	Aug 6, 2015
probability 31	2	Aug 6, 2015
probability 21	2	Aug 6, 2015
probability 1a2	2	Aug 6, 2015
adding and subtracting areas1	2	Jul 27, 2015
area perimeter compound shapes 3a1	9	Jul 23, 2015
area perimeter compound shapes 21	10	Jul 23, 2015
area perimeter compound shapes 11	2	Jul 23, 2015



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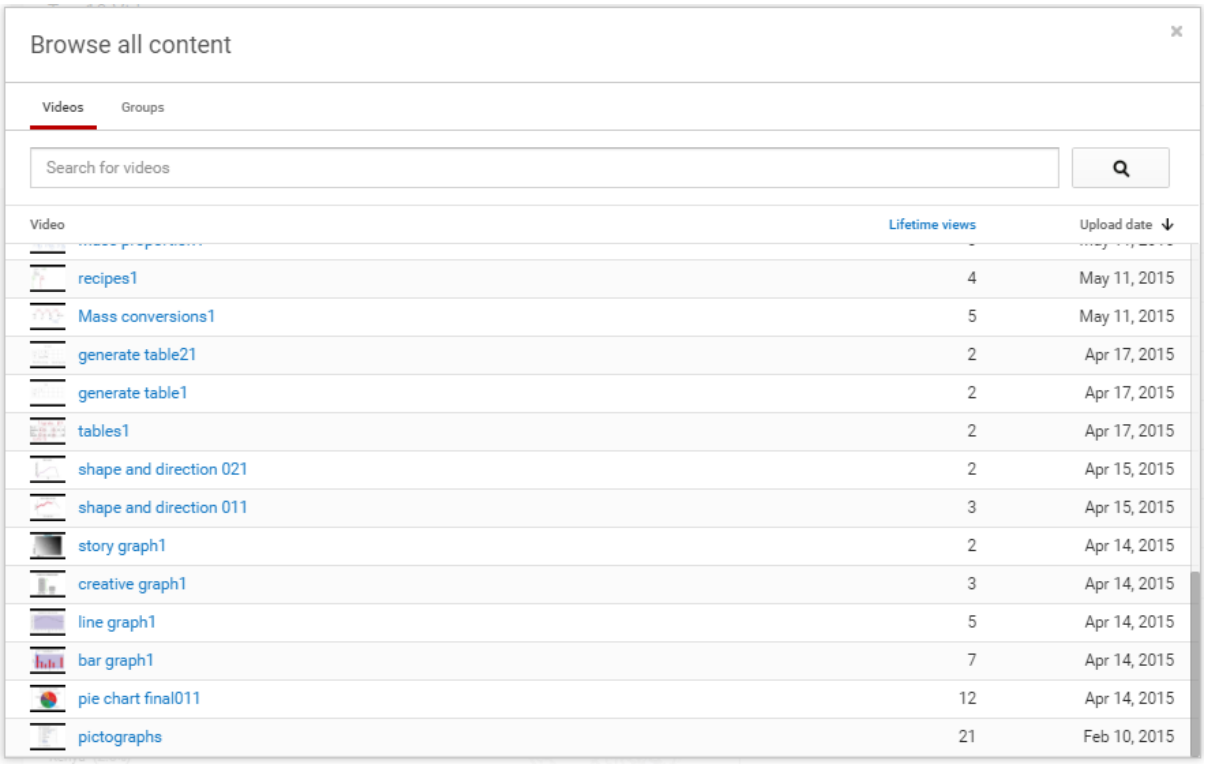
Videos | Groups

Search for videos

Video	Lifetime views	Upload date
area perimeter compound shapes 11	2	Jul 23, 2015
circumference and area semi circle final1	11	Jul 22, 2015
maths joke1	10	Jul 21, 2015
perimeter area triangle1	2	Jul 21, 2015
circumference area circle1	2	Jul 21, 2015
perimeter area rectangle1	2	Jul 21, 2015
scale31	2	May 15, 2015
scale11	3	May 15, 2015
temperature1	4	May 13, 2015
volume ratio1	2	May 13, 2015
Mass costs1	2	May 11, 2015
Mass proportion1	3	May 11, 2015
recipes1	4	May 11, 2015

Appendix M


Browse all content
Videos
Groups
Search for videos
Video
Lifetime views
Upload date
recipes1 4 May 11, 2015
Mass conversions1 5 May 11, 2015
generate table21 2 Apr 17, 2015
generate table1 2 Apr 17, 2015
tables1 2 Apr 17, 2015
shape and direction 021 2 Apr 15, 2015
shape and direction 011 3 Apr 15, 2015
story graph1 2 Apr 14, 2015
creative graph1 3 Apr 14, 2015
line graph1 5 Apr 14, 2015
bar graph1 7 Apr 14, 2015
pie chart final011 12 Apr 14, 2015
pictographs 21 Feb 10, 2015

Index of Videos

No.	Topic	Worksheet	Comments
1	Pictographs	Different types of graphs	I created these videos to help students better understand different types of graphs. I used visual representations of the different graphs, explaining and demonstrating how to read off and interpret the information.
2	Pie chart	Different types of graphs	
3	Bar graph	Different types of graphs	
4	Line graph	Different types of graphs	
5	Creative graph	Different types of graphs	
6	Story graph	Different types of graphs	
7	Shape and direction 1	Shape and direction of graphs	I created these videos to help students make sense of reading graphs. The videos clearly show how the shape and direction of a graph conveys information, and how to interpret that information.
8	Shape and direction 2	Shape and direction of graphs	
9	Tables	Filling in and generating tables	I created these videos to help students draw up and fill in tables conveying relationships between different sets of data. This is a slightly more complicated section, and these videos explain the process step by step, in a simple manner.
10	Generate tables 1	Filling in and generating tables	
11	Generate tables 2	Filling in and generating tables	
12	Mass conversions	Measuring mass	I created these videos to help students with simple conversions within the metric system, as well as working with ratios, in practical contexts. The videos also explain how to work with proportions.
13	Recipes	Measuring mass	
14	Mass proportion	Measuring mass	
15	Mass costs	Measuring mass	
16	Volume ratio	Volume and temperature	I created this video to explain proportion and working with different volumes of liquids in proportion.
17	Temperature	Volume and temperature	I created this video to demonstrate how to convert from degrees Celsius to degrees Fahrenheit, and vice versa, using a simple formula.
18	Scale 1	Maps and scale	I created these videos to help explain the concept of scale on a map, and to demonstrate how to use ratios to convert a distance on a map to real life, and vice versa.
19	Scale 2	Maps and scale	
20	Perimeter, area rectangle	Area and perimeter 1	I created these videos to show how the perimeter and area of basic shapes can be calculated.
21	Circumference, area circle	Area and perimeter 1	
22	Perimeter, area triangle	Area and perimeter 1	
23	Maths joke	Area and perimeter 1	I created this video as an attempt to pique the interest of the students.
24	Circumference, area semi-circle	Area and perimeter 1	I created this video to show how the circumference and area of a semi-circle can be calculated.

25	Area, perimeter compound shapes 1	Area and perimeter 2	I created these videos to help students calculate the area and perimeter of more complex shapes, using various compound shapes as examples.
26	Area, perimeter compound shapes 2	Area and perimeter 2	
27	Area, perimeter compound shapes 3	Area and perimeter 2	
28	Adding and subtracting areas	Area and perimeter 3	
29	Probability 1	Probability 1	I created these videos to help students better understand the concept of probability, as it is one of the more difficult sections. The videos demonstrate how to calculate the probability of simple events, such as picking a sweet of a specific colour from a bag of sweets.
30	Probability 2	Probability 1	
31	Probability 3	Probability 1	
32	Probability 4	Probability 1	
33	Probability 5	Probability 1	
34	Socks	Probability 2	I created these videos to demonstrate how to calculate the probability of more complex events. Another aim of these videos was to encourage the students to think carefully and logically.
35	Gloves	Probability 2	
36	Coins table	Probability 2	I created these videos to demonstrate how to depict all possible outcomes of an event, either with a table or by drawing a tree diagram.
37	Tree diagram	Probability 2	

Note on creation of videos

I reviewed each video after creating it, making any changes I felt necessary. Once I was satisfied with both quality and content, I sent it to two friends for further review and critique. These two friends both have experience in teaching; one is a school teacher and the other a part-time university lecturer. On the whole, they found the videos to be watchable and informative, and were happy with the quality and instructional methodology. In the instances where they had comments and suggestions, I re-watched the video in question, and implemented these suggestions if I felt that they were warranted. These comments were also taken into account, and informed the creation of subsequent videos. There were not many comments, but they mostly highlighted areas in the videos that could potentially be confusing to the students, and could perhaps be explained more simply and clearly. Other comments pertained to the audio quality, as well as the legibility of numbers written on the screen. After going through this review process, the videos were uploaded to YouTube. Once uploaded, I did not change or refine the videos based on students' suggestions, for the reason that once the students had completed each worksheet and provided their feedback on the relevant videos, they would be unlikely to re-watch the videos. It would also have been difficult to re-upload edited videos, as the URL, and therefore the QR code, would change, meaning a new QR code would be required for students to access the edited video.